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MACKENZIE VALLEY PIPELINE INQUIRY

IN THE MATTER OF APPLICATIONS BY EACH OF

- (a) CANADIAN ARCTIC GAS PIPELINE LIMITED FOR A RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS CROWN LANDS WITHIN THE YUKON TERRITORY AND THE NORTHWEST TERRITORIES; and
 - (b) FOOTHILLS PIPE LINES LTD. FOR A RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS CROWN LANDS WITHIN THE NORTHWEST TERRITORIES,
- FOR THE PURPOSE OF A PROPOSED MACKENZIE VALLEY PIPELINE

and

IN THE MATTER OF THE SOCIAL, ENVIRONMENTAL AND ECONOMIC IMPACT REGIONALLY OF THE CONSTRUCTION, OPERATION AND SUBSEQUENT ABANDONMENT OF THE ABOVE PROPOSED PIPELINES

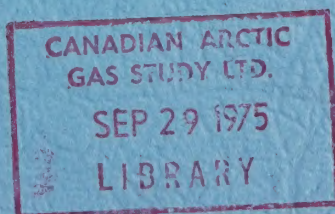
(Before the Honourable Mr. Justice Berger, Commissioner)

Yellowknife, N.W.T.

September 24th 1975

PROCEEDINGS AT INQUIRY

Volume 68



APPEARANCES:

Mr. Ian G. Scott, Q.C.
Mr. Stephen T. Goudge,
Mr. Alick Ryder and
Mr. Ian Roland for Mackenzie Valley
Pipeline Inquiry;

Mr. Pierre Genest, Q.C.
Mr. Jack Marshall,
Mr. Darryl Carter, for Canadian Arctic Gas
Pipeline Limited;

Mr. Reginald Gibbs, Q.C.
Mr. Alan Hollingworth for Foothills Pipelines
Ltd.;

Mr. Russell Anthony,
Prof. Alastair Lucas for Canadian Arctic
Resources Committee;

Mr. Glen W. Bell and
Mr. Gerry Sutton for Northwest Territories
Indian Brotherhood and
Metis Association of the
Northwest Territories;

Ms. Leslie Lane for Inuit Tapirisat of
Canada and the
Committee for Original
Peoples' Entitlement;

Mr. Ron Veale and
Mr. Allen Lueck for Yukon Native Brother-
hood;

Mr. Carson H. Templeton for Environment Protect-
ion Board;

Mr. David Reesor for Northwest Territories
Association of Muni-
cipalities

Mr. Murray Sigler for Northwest Territories
Chamber of Commerce

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CANADIAN ARCTIC
GAS STUDY LTD.

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Yellowknife, N.W.T.

September 24th, 1975.

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

THE COMMISSIONER: Well, we
will come to order, ladies and gentlemen.

Mr. Hollingworth?

MR. SCOTT: Mr.

Commissioner, before Mr. Hollingworth begins, I wonder
if the map that is just below the table which was
referred to yesterday could be made an exhibit. I
understand Mr. Hollingworth contemplated that it would
be and I did too, and perhaps it should be marked if
Miss Hutchinson will give us the next number.

MR. HOLLINGWORTH: Yes that
was just an oversight, yesterday, Mr. Commissioner.

(LOGISTICS MAP _ FOOTHILLS PIPELINE MARKED
AS EXHIBIT NUMBER 264)

MR. HOLLINGWORTH: The eleventh
and final panel of the Phase 1 evidence of Foothills
Pipe Lines Limited. It was intended to have Mr. A.L.
Paul, Superintendent of Operations and Maintenance of
Foothills Pipe Lines present on the panel with Mr.
Hushion. Mr. Paul is quite ill, and is not able to come
here. I have spoken at least to Mr. Scott and Mr.
Genest about it, and in his place we have put forward
Mr. Mirosh and Mr. Dick Littledale.

Littledale, Mirosh, Hushion
In Chief

My intention would be to have Mr. Hushion read the evidence in and have Messrs. Mirosh and Littledale available to answer -- field questions whenever it seems appropriate, and prior to getting into the printed notes, if I could ask some questions of Mr. Littledale.

RICHARD LITTLEDALE, Sworn:

EDWARD A. MIROSH, Resumed:

D. HOWARD HUSHION, Resumed:

DIRECT EXAMINATION BY MR. HOLLINGWORTH:

Q Mr. Littledale, I understand you're presently manager of Process and Construction for Westcoast Transmission Company Limited?

WITNESS LITTLEDALE:

A Yes, that's right.

Q And you will becoming involved with Foothills Pipe Lines in the Operations and Maintenance end of things in the very near future, is my understanding correct there?

A That is correct.

Q I wonder if you could just give us a brief outline of your academic qualifications and your history of employment?

A Yes, I completed Indentured Apprentiship - engineering apprenticeship program, Rugby in England, and I'm a certified engineering technologist in British Columbia. 1950 to 1952, I worked

Littledale, Mirosh, Hushion
In Chief

1 on a joint pipeline project between Bechtel and Wimpey
2 in the Middle East, and in 1952, I joined Interprovincial
3 Pipeline Company out of Edmonton, and I was with them
4 from 1952 to 1963.

5 From 1952 to 1957 was spent
6 with the engineering construction group; 1957 to 1963,
7 was operations; 1963 to 1966, I came over to British
8 Columbia and joined Western Pacific Products and Crude
9 Oil Pipelines; I was assistant superintendent of
10 operations for them for six months, and then I was
11 promoted to Superintendent of Operations and stayed with
12 them for three years.

13 Then I transferred to West-
14 coast Transmission and from 1966 to 1969 I was Assistant
15 Superintendent of Transmission and after that I became
16 Superintendent of Transmission, Manager of the Southern
17 District; Manager of Transmission and I'm presently
18 manager of Process and Construction.

19 Q Thank you, Mr. Littledale.
20 Now we will move to the prepared evidence.

21 Mr. Hushion, you're the Exe-
22 cutive Vice-President of Foothills Pipe Lines Limited?

23 WITNESS HUSHION:

24 A Yes.

25 Q And you've previously
26 appeared before this inquiry on the metallurgy panel
27 and some community hearings?

28 A Yes.

29 Q Would you provide the
30 Commissioner with an overview of Foothills' operations

Littledale, Mirosh, Pushion
In Chief

1 and maintenance plans with respect to the proposed gas
2 line system from the Beaufort Basin to approximately
3 the 60th parallel?

4 A Yes. Foothills' O & M
5 plans are developed in Part 3F of our application to
6 the National Energy Board and the Department of Indian
7 Affairs. Environmental and socio-economic considerations
8 with respect to operations and maintenance are detailed
9 in Parts 5C and 5D. Other panels for the appropriate
10 phase of this Inquiry will address in depth the environ-
11 mental and socio-economic considerations.

12 In developing the proposed
13 O & M plans, Foothills was able to utilize first the
14 extensive experience of the Alberta Gas Trunk Line
15 Company Limited in operating a large gas transmission
16 network extending into the northern reaches of Alberta
17 and second, the active participation by AGTL in develop-
18 ment of the Canadian Arctic Gas Study Limited proposals
19 for O & M plans while AGTL was still a member of that
20 consortium.

21 Through the above experience
22 and participation Foothills adopted a new posture
23 recognizing that:

24 (a) the character of the
25 pipeline company in the Territories should be more
26 northern oriented.

27 (b) where facilities south
28 of 60 degrees latitude exist, an entirely new pipeline
29 system would only provide an unnecessary duplication
30 of facilities.

1 Accordingly, to provide a com-
2 pany which was more oriented to the northern community
3 the decision was made by Foothills to incorporate into
4 the O & M planning the provision for locating the
5 Operation's Head Office in Yellowknife. Additionally,
6 Foothills adopted as corporate policy, the provision of
7 gas service to selected communities along the proposed
8 pipeline route and the operation and maintenance of
9 these lateral connections as an integral part of the
10 O & M plans.

11 To prevent duplication of
12 facilities south of 60 degrees latitude, AGTL has pro-
13 posed utilizing its spare system capacity and increment-
14 ing its facilities, where necessary, to accommodate
15 projected volume throughputs.

16 Q Would you elaborate on
17 the significant differences between the O & M plans
18 as advanced by Foothills and CAGPL?

19 A First, the Operations Head
20 Office proposed for Yellowknife is in contrast to the
21 CAGPL proposed location for this facility in southern
22 Canada.

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1 facilities for various mechanical and electrical main-
2 tenance and modifications of operating equipment, and
3 as a consequence, provide varied employment opportunities
4 for northerners. The similar CAGPL facility is understood
5 to be located in southern Canada.

6
7 Thirdly Foothills proposes to
8 employ a staff environmentalist at each of the district
9 offices. As the environment changes throughout the
10 pipeline route, environmental concerns can be isolated
11 and dealt with at the working level. A similar position
12 is not indicated in CAGPL's O&M organization.

13 Fourthly, a significant
14 departure of the Foothills's proposal from that of
15 CAGPL involves the extent of permanent facilities which
16 would be operated and maintained. Foothills proposes a
17 much smaller scale of permanent facilities with a
18 consequent smaller operations and maintenance requirement
19 and a resultant diminished environmental impact.

20 To quantify the extent of
21 permanent facilities, excluding the right of way, Foothills
22 would have to maintain a land use area of approximately
23 600 acres as compared to the CAGPL requirement of approxi-
24 mately 5,000 acres, a factor of about 8 to 1. In terms
25 of borrow material requirements for permanent facilities
26 Foothills would have to maintain approximately 3 million
27 cubic yards as compared to the CAGPL requirement of
28 23 million cubic yards, again a factor of about 8 to

29 These significant differences
30 can be largely attributed to the following:

(a) Foothills would not have to

1 operate and maintain a large diameter pipeline system
2 across the sensitive Yukon coastal and Mackenzie Delta
3 area between the Alaska/Yukon border and Travailliant
4 The Inuvik district office in the Foothills proposal
5 would only be responsible for approximately 250 miles of
6 pipeline and related facilities.

7 (b) Foothills does not
8 propose to operate large airstrips for fixed wing aircraft
9 at compressor stations. CAGPL on the other hand, proposes
10 the operation of eight airstrips in the Territories, each
11 comprising an area of approximately 175 to 300 acres and
12 each having a borrow material requirement of one half
13 million to one million cubic yards. Besides having to
14 maintain these airstrips, the following disadvantages are
15 apparent:

16 (i) to meet Ministry of
17 Transport IFR landing regulations, the airstrips must be
18 planned

19 (ii) The topographical requirements of an airstrip may dictate that it be well
20 from the compressor station necessitating additional
21 access roads to be constructed and maintained.

22 (iii) During adverse weather
23 conditions, the airstrip may have to be ploughed prior
24 to use.

25 The Foothills plan, as outlined
26 would utilize fixed wing aircraft support only at
27 airstrips. The prime mode of transportation would be
28 ground transport, appropriate for the season and terrain,
29 supplemented with helicopter support as required.
30

(c) Another significant departure in the O&M plan, Foothills vs CAGPL, is in the operation and maintenance of wharf facilities,. Foothills does not propose the construction and maintenance of permanent wharves along the Mackenzie River while CAGPL proposes the construction and operation of eleven permanent wharves adjacent to compressor station sites which already would have all-weather road access, helipor and/or airstrips.

It is the intention of Foothills to upgrade existing wharves if acceptable to the nearby communities, and if useful access to the pipeline facilities is available over all weather access roads. The majority of large tonnage requirements would have occurred during the construction phase with very limited tonnage contemplated for the operational phase. Portable wharf facilities can be utilized, if the need arises, with minimum effort and disturbance.

(d) The acreage requirement of compressor stations for CAGPL vs Foothills is approximately 2 and a half to one; CAGPL requires approximately 25 acres per chilled station vs the Foothills requirement of 11 acres per station. The reduced land area in the Foothills case will require less annual maintenance on such items as the gravel pad, fencing, fire breaks, and drainage provisions.

The fifth difference occurs as a consequence of the volume build up schedules proposed by both applicants. Foothills proposes a gradual throughput increase with an associated gradual increment to compressor station facilities. This build up schedule allow

1 a greater degree of flexibility with respect to on-site
2 experience and the application of that experience to steel
3 construction in succeeding years. This situation
4 contrasts to the CAGPL case where large throughputs
5 are planned for the initial system.
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1 MR. HOLLINGWORTH: The panel
2 is available for cross-examination, sir.

3
4 CROSS-EXAMINATION BY MR. CARTER:

5
6 Q Mr. Hushion, I wonder if
7 I could begin by referring you to a section in your
8 application dealing with O & M, and it's found at page
9 3F-34.

10 A Yes, I have that.

11 Q Now right at the top of
12 that page, sir, the following statement is made:
13 "In the southern portion of the pipeline Operations
14 and Maintenance procedures will be similar to those used
15 on other gas pipeline systems operating in these areas".
16 Could you tell me, Mr. Hushion, which pipeline systems
17 you're referring to there?

18 A Oh, I think that would
19 much similar to the northern part of the Alberta Gas
20 Trunk Line system.

21 Q I see, and you consider
22 that to be in the same area as the southern part of the
23 Foothills system, just say between Fort Simpson and the
24 60th parallel?

25 A Yes, it's just an exten-
26 sion -- well from Zama Lake up across the border and
27 towards Fort Simpson.

28 Q So your intention would be
29 to operate and maintain the Foothills' system on the
30 southern portion in a similar manner to that that Trunk

1 Lines employs in northern Alberta?

2 A Well wherever the systems
3 are generally the same, if it's the same type of terrain
4 the same type of access, well we would operate it in
5 the same general manner, yes.

6 Q And in your view, is the
7 terrain similar?

8 A Well it's progressively
9 changing as you go further north, but the change isn't
10 that abrupt as you go from the end of the Alberta Gas
11 Trunk Line system, as I say towards the 60th parallel,
12 and on up to Fort Simpson. It is getting, of course,
13 into the discontinuous permafrost and then progressing
14 on to permafrost.

15 Q I see.

16 A It must be the same as it
17 is as the very southern part of the Alberta system to
18 its northern extremities.

19 Q I was wondering what the
20 reference was, and as I understand it it's to the Trunk
21 Line system in northern Alberta?

22 A Yes.

23 Q In the Zama Lake area?

24 A M'hmm.

25 Q Now, --

26 A I might add that Westcoast
27 has the same similarity too. They have progressed,
28 of course, into the Territories already, so it would be
29 the same as their operations in the northern part of
30 their system.

1 Q Well I wondered about that,
2 Mr. Hushion, in that the statement refers to gas pipe-
3 line systems, in the plural, so that would mean both
4 Westcoast and Trunk Lines Northern Alberta --

5 A Yes, that would include
6 the presently two operating systems that are operating
7 in northern Alberta, northern B.C. and in the case of
8 Westcoast, into the Territories with their Pointed
9 Mountain Line.

10 Q I see. The Westcoast
11 system you're referring to is to Pointed Mountain in the
12 Northwest Territories?

13 A Well that's the furthest
14 extremity of their system, so it would be the one that
15 you refer to, from there on down to the northern part
16 of B.C.

17 Q Yes. Now, --

18 A The terrain from Fort
19 Nelson up to, as I am sure Mr. Littledale could attri-
20 bute to, is much similar to the northern Alberta and
21 the southern -- around the 60th parallel, on both
22 systems, the Alberta Gas Trunk Line and the Westcoast
23 system.

24 Q I see. When you refer to
25 the southern portion of the pipeline in this statement,
26 could you tell us what area is that? Would that be
27 from Fort Simpson south?

28 A Well generally speaking,
29 yes. I think it becomes as you go just a little bit
30 further south, they become much more the same, yes.

Littledale, Mirosh, Hushion
Cr. Exam. by Mr. Carter

Q Now, if I could deal with another matter, and I discussed this somewhat with Mr. Mirosh on the communications panel, and that is the decision of Foothills to have its head office and control centre at Yellowknife. And you point out that this is a difference between your proposal and Arctic Gas. Is there anything about the Arctic Gas proposal to have one central control centre and head office in Calgary for their whole system in both the Northwest Territories and Alberta, is there anything that's not feasible about that sort of approach?

A I think that the head operating office should be located in the Northwest Territories. Of course Foothills is a Northwest Territories oriented pipeline company. The -- considering the fact that there is chilling on the line and it does have its own idiosyncrasies, if you will, I think that it should be operated as an independent system.

Q That's a decision that Foothills has made, but what I am wondering is was it for any technical reason that you determined it was not feasible to have one control centre in Calgary, say?

A I suppose you could control any system from any place if you wanted to. It is remote, and the distance of the remoteness is not necessarily that important, but I still think by the same token that it should be as close to the actual operating system as possible.

It's more fitting to have it that way.

1 Q Well dealing with that
2 then, Mr. Hushion, I also asked this of Mr. Mirosh at
3 that time, why did you choose Yellowknife? It seems to
4 be more, to use your term remote from the main line
5 system at least. It's not along the main line system,
6 and I wondered why you chose Yellowknife?

7 A Well it is in the Terri-
8 tories. It's close, of course, to the lateral into
9 Yellowknife, but I think it has some other reasons.
10 It has transportation facilities, it is a locale where
11 you can attract people to work. It has the required
12 social requirements, if you will, the amenities that
13 people like in order to attract qualified workers.

14 Q These would be people that
15 you are trying to attract from the south?

16 A Well there are certain
17 ones that will have to be in as we were discussing through
18 last week and this week, there are only certain jobs
19 that can be filled by northerners, at least in the ini-
20 tial stages. You need some people -- for example,
21 there are no gas controllers, those would have to be
22 brought in. This is a good thing. It supplies jobs for
23 the local people, which I think is important, and
24 different types of jobs. We would have purchasing
25 people, there would be administrative people, secretar-
26 ies, typists, clerks, that will have jobs provided for
27 them in the Territories. These can be obtained locally
28 by having it in the Territories. You purchase locally,
29 this would be a natural thing.

30 Other companies seem to have

Littledale, Mirosh, Hushion
Cr. Exam. by Mr. Carter

1 their head offices or their headquarters in Yellowknife,
2 and besides we have the three districts in Inuvik,
3 Norman Wells and Simpson, so it was a nice spread of
4 facilities throughout the Territories.

5 Q I see. And as you say,
6 by having your control centre in the Northwest Terri-
7 tories, you keep Foothills as a self-contained project,
8 if I can put it in that term, within the Northwest
9 Territories?

10 A Yes, very much so.

11 Q If I could refer you now,
12 Mr. Hushion to page 4 of your prepared evidence,
13 towards the bottom of that page you deal with some
14 significant differences between the two proposals, and
15 if I could deal with one or two of them.

16 The first one that is lettered
17 (a) points out that Arctic Gas has about 250 miles of
18 more line to look after, this being because of their
19 bringing Alaska gas across the North Slope, and I'm
20 wondering if you have taken into the account, as I
21 understand it, some 490 miles of laterals that Foothills
22 proposes as an integral part of its project?

23 A Yes, we are mentioning
24 that the Inuvik district only handles -- is only
25 responsible for 250 miles, we are excluding, of course,
26 the lake from Prudhoe Bay to Travaillant Lake, as far
27 as the CAGPL system is concerned.

28 Q As an overall project,
29 though, it could be said that Foothills with its laterals
30 as part of its whole project, has I suppose even more
miles of pipeline than Arctic Gas?

1 A Yes, there's some 460
2 miles of laterals that we plan to put in for service
3 to communities, yes.

4 Q Now the next difference
5 that you point out, lettered "b" deals with the fact that
6 Arctic Gas proposes to use fixed wing aircraft and
7 airstrips as opposed to Foothills. And as I understand
8 it, Foothills^{would} employ helicopters rather than fixed
9 wing aircraft. Could you tell me something about the
10 types of helicopters that you propose to use, the
11 size, the make if you know that now, how many you'd
12 have, load capacity, that sort of thing?

13 A Well, we've planned on
14 leasing helicopters, and this is one of the things, in
15 an attempt to promote businesses in the three districts
16 that we'd be working out of. It would depend on what
17 helicopters really are available at that particular time.
18 The ones for operation are not necessarily the huge
19 ones. We will have contracts with the people in the
20 area for supply of larger helicopters, something like,
21 we mentioned, the Sikorski 61 or even perhaps when the
22 pipeline is constructed if it is, there would
23 be something larger, better, more proved at that time.
24 I think we're all faced with that type of thing. The
25 most modern equipment available is what we'll purchase
26 what that happens. So, we'd have a lease arrangement
27 with people in each district for both maintenance and
28 in cases of emergency.

29 Q And these would have, I
30 take it, sufficient load capacity for whatever you can

1 foresee would be necessary in the operations and
2 maintenance?

3 A Certainly we'd be looking
4 at the ones at that time that have the largest sling
5 load if you will. In the present day, I think it's
6 about 8,000pounds maybe stripped down, which is
7 satisfactory for our needs. But however, you would
8 keep your, you're continually progressing and you're
9 aware of what's available. I think we're always doing
10 this in our business.

11 Q I see. Now, turning
12 over to the next page, page five, under the small letter
13 (i) you refer to a Ministry of Transport regulation
14 requiring that airstrips be manned for IFR landing
15 regulations, and in that connection, Mr. Hushion,
16 I'm advised that in IFR conditions, you're required to
17 have someone on the ground whether you're landing with
18 fixed wing or with helicopters, have you any information
19 in that regard?

20 A No, not specific. Mind
21 you, we're not -- I believe that in the present day,
22 there isn't that much sophisticated equipment with the
23 helicopters as far as IFR equipment is concerned, although
24 they're moving towards that and this is starting to
25 happen. Now we discussed a beacon as being available at
26 the heliports for helicopter landings which can be used
27 and monitored into our control systems, into the district
28 offices so that you would know that's available without
29 having it being manned.

30 Q I'm told that the existing

1 regulations require this man on the ground in both
2 cases. Now they may be changed, but if that were so,
3 would it not be the case that there would be no
4 difference between the proposals in the sense that they
5 both require a man on the ground, whether it was fixed
6 wing or helicopter?

7 A Well of course, you would
8 need it all the time with an airstrip, but it isn't
9 absolutely a requirement. It would be a nice addition
10 to a helicopter use if we were able to have IFR, although
11 we would depend then whether we were going to keep a man
12 there. I don't think you'd do that.

13 Q I'm wondering about the
14 large number of hours of darkness in the north. Wouldn't
15 IFR be required during those times?

16 A Well of course, the
17 darkness would limit it mind you but we're saying that
18 ground transport is available to us too. This is the
19 primary use. We're not saying that we're going to be
20 flying all the time. It's a helicopter support to that.

21 Q I'm also told that heli-
22 copters cannot use a sling if they're operating under
23 IFR conditions, were you aware of that regulation?

24 A No, I'm not that familiar
25 with the regulations.

26 Q But as you say, you intend
27 to use ground transport and I believe the statement just
28 below that on page-5 is that this would be the prime
29 mode of transportation, do I understand that correctly?

30 A Yes sir, wherever possible.

1 Q In that connection, Mr.
2 Hushion, have you any studies or reports dealing with
3 the question of whether ground transport is your primary
4 mode backed up by helicopters is preferable to the
5 construction of airstrips and the use of fixed wing
6 aircraft from your environmentalists' point of view.

7 A Well we haven't made a
8 specific study to compare one to the other. Well
9 we have in our own thinking looked at this and decided
10 certainly, with the available ground equipment that's
11 available to us now, that there's really not much
12 doubt that that's the type of equipment that should be
13 used primarily.

14 Q Moving along, then, with
15 these differences, Mr. Hushion, the next one at the top
16 of page 5, is lettered two little i's and you state that
17 Arctic Gas with their airstrips will require access
18 roads, and in that connection, I wondered if Foothills
19 would not require a large number of access roads as
20 well to get it to the highway or winter road or whatever
21 ground transport right-of-way you intended to use?

22 A We certainly need some
23 access but we're saying that we -- for every airstrip,
24 you have to have an access road to and from it and it
25 may be quite distant. You'd have to pick out a reasonable
26 area to have a 6 or 8 thousand foot strip. We'd propose
27 to use the right of way wherever possible, certainly
28 and in wintertime/with low ground pressure vehicles in the
29 summertime. You don't need access roads from heli-
30 copers is what we're saying.

1 Q In preparing your O & M
2 application, I take it, am I correct in stating that
3 you assumed that the Mackenzie Highway would be constructed?

4 A Well we did assume that
5 but we also have a secondary thinking that the equipment
6 would be located in accessible compressor stations for
7 maintenance and repair work.

8 Q If it were constructed,
9 you would then require access roads to the highway
10 from the compressor stations.

11 A Certainly, yes.

12 Q If not, you intend to
13 move up and down the right of way wherever possible?

14 A Certainly you would use
15 the high speed highway wherever you could. Naturally
16 you get there and then easier access roads to the right
17 of way.

18 Q Now, Mr. Hushion
19 I take it that and I believe you stated this
20 just a little earlier, that one of the novel features
21 about this project and Arctic Gas's as well, and I'm
22 speaking now from an operations and maintenance point
23 of view, will be the fact that the gas will be chilled,
24 is that fair to say?

25 A Yes.

26 Q Would it be also fair to
27 say then that the experience from an operations and
28 maintenance point of view in operating a chilled gas
29 line, does not exist but it will be something that will
30 be acquired as time goes on?

1 A Yes, I suppose that's
2 true.

3 Q In that connection then,
4 I would like to, if I may, refer you to the last paragraph
5 of your prepared evidence. and as I understand what you're
6 stating there, you're saying that in your project, you
7 will have a more gradual build up of facilities and this
8 will give you more opportunity to iron out the bugs, so
9 to speak?

10 A Yes.

11 Q As I recall Mr. Mirosh's
12 testimony on the design of the compressor stations, he
13 said that Foothills as opposed to Arctic Gas, would
14 install chilling facilities at every compressor station
15 in the first instance, and I'm wondering if this
16 wouldn't then give you the same opportunity as
17 Arctic Gas to make changes to these facilities if
18 experience proved that these were necessary?

19 A I believe that our first
20 years is two stations and four chilling stations, is
21 that correct?

22 WITNESS MIROSH:

23 A Yes, the first year is
24 two full stations and four chilling and then in some
25 cases the chilling is added at the same time as the
26 compression, so your statement wasn't totally correct.

27 Q I didn't understand
28 what you said then correctly, I take it?

29 My understanding was that you
30 made a distinction between the two proposals and that was

1 that you would have chilling at all the stations in the
2 first instance, whereas Arctic Gas would only install
3 them as they put on compression.

4 A That's correct, during
5 the early years, we propose to install chilling stations
6 in locations where we don't require compression.

7 Q My question then was
8 having installed these, I suppose it's not proper to say
9 ahead of time, but having installed these chilling
10 facilities, if it turned out that there should be some
11 modification to them, you wouldn't have the same
12 flexibility if you had only installed those where you
13 had compression because they had already been installed?

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1 A Yes, but if there were
2 modifications required and I can't imagine what they
3 would be, they could be modified at the stations after
4 installation.

5 MR. CARTER: I have no further
6 questions.

7 THE COMMISSIONER: Thank you,
8 Mr. Carter.

9 Mr. Bayly?

10 Mr. Bell?

11
12 CROSS-EXAMINATION BY MR. BELL:

13
14 Q I see from your direct
15 testimony that you plan to locate the maintenance and
16 supply depot at Fort Simpson, which is a district head-
17 quarters, and I was wondering if you considered any
18 other district headquarters for this facility?

19 WITNESS HUSHION:

20 A Well we have three dist-
21 ricts. There's one at Inuvik, one at Norman Wells and
22 one at Fort Simpson.

23 Q Did you consider locating
24 this at Inuvik or Norman Wells?

25 A You're referring to the

26 --

27 Q The maintenance supply
28 depot?

29 A Yes.

30 Q And --

1 A Well yes, but it was our
2 decision that it was much like the decision on Yellow-
3 knife, but this was maybe a more accessible spot and it
4 could service the area generally and it would be within
5 reaches of the highway. You could get materials there
6 and people, and move equipment in and out as necessary.
7 It had those advantages.

8 Q You still have to fly it
9 to Inuvik though?

10 A Yes, but only when
11 required. This would be the base where things would be
12 held, and in the cases of being required.

13 Q Well I am just wondering
14 if it would cause any great inconvenience if this depot
15 were located at Norman Wells or Inuvik. It seems to me
16 that Norman Wells is more centrally located to the pipe-
17 line operation?

18 A Well it is as far as if
19 you just want to put it into the middle of the pipeline,
20 but for example you would be relying on flying at least
21 for a while, since we don't have any highway to move up
22 yet except the winter road that is still there, which
23 could be used, but it isn't -- it wouldn't -- you
24 wouldn't be able to move equipment or heavier equipment
25 along that like you would along the highway. So at
26 least you have the advantage of the highway into
27 Simpson.

28 Q But I take it it would be
29 feasible to locate it at either of these other two
30 centres?

1 A Oh, I suppose you actually
2 could if it were necessary. I think it would become a
3 little more awkward, certainly in the initial stages.
4 Mind you your system changes and perhaps grows as you
5 go along in the normal pipeline company. Maybe later on
6 you would find that you wished that you were in say,
7 Norman Wells, and you might relocate then or add an
8 additional one, but I think for the present time that
9 Simpson is probably a satisfactory location.

10 Q And I see in your applicat-
11 ion at page 3F4, this is in a list of assumptions which
12 were used in developing the operating time, and in
13 assumption E --

14 A What page is this, please,
15 Mr. Bell?

16 Q 3F4.

17 A Oh. Yes.

18 Q And assumption E says
19 that you assume proposed district headquarter locations
20 will receive local authorities' approval, and I was
21 wondering what exactly what you meant by local author-
22 ities in that case?

23 A Well certainly we would
24 like to locate the facilities in places that I guess
25 where we are wanted, if you will. You have to discuss
26 these, of course, with the local people. This would be
27 the town council, I suppose the Indian band chief too,
28 and -- in order to learn whatever Ordinances or whatever
29 requirements they might have in each district. It's
30 just a matter of discussing with them what we are

1 proposing and if that's satisfactory to them, and where
2 we would put the facilities such as our headquarters,
3 our warehouse and the housing that's involved with it
4 too.

5 I suppose the use of the word
6 authorities is just, you know, whatever authorities you
7 think you should discuss it with and that you should
8 discuss it with.

9 Q Well do I understand you
10 to say then if a local council, a settlement council or
11 a band council did not approve of your locating the
12 district headquarters in their community, that you
13 wouldn't do it?

14 A Well we would hope that
15 that wouldn't arise, but certainly if we weren't wanted
16 in an area, then we would maybe move to Norman Wells
17 from Simpson, for example, or some other place.

18 MR. BELL: Thank you, that's
19 all I have.

20
21 CROSS-EXAMINATION BY MR. BAYLY:

22
23 Q Mr. Hushion, in your pre-
24 pared evidence, question 5, you contrast your proposal
25 to Arctic Gas' proposal in that you plan to have your
26 operations head office at Yellowknife, and you go on in
27 your answer on page 3, to say in the last sentence,
28 "As such, northern residents would be provided with a
29 greater variety of employment opportunities in such
30 areas as accounting, engineering, purchasing and the

1 employee relations". Now from that it appears that you
2 would contemplate employing people already in the north
3 at this headquarters, is that correct?

4 A Well we would certainly
5 hope that would happen. In those areas there is no
6 reason why we wouldn't be able to obtain qualified
7 northerners to fill those positions, --

8 Q Yes.

9 A -- and if not, they could
10 certainly be trained to fill them in due time.

11 Q And you have said in the
12 sentence before that that you would anticipate that
13 your staff level in the fifth year would be 56 at this
14 headquarters, is that correct?

15 A Yes, that is correct.

16 Q And it has been stated
17 earlier in your evidence, though not of this panel, that
18 you would plan to have some 56 staff houses in Yellow-
19 knife; is that correct?

20 A Yes, in general terms.
21 Certainly enough to satisfy the 56 employees, but there
22 was the term houses, I think that this needs to be
23 worked out. It depends on the number of married people
24 and the number of single people, whether you would put
25 somebody into two or three bedroom homes, or perhaps
26 apartment type for single people.

27 Q Well, assuming that some
28 of the people are already here, why do you have to pro-
29 vide all this additional accommodation?

30 A Well we wouldn't have to

1 for all of them, I suppose, but then again, we under-
2 stand that there is a housing problem too and perhaps
3 this might contribute to some assistance in that regard
4 as far as housing.

5 We are not -- if there isn't
6 any need for the housing, then there is no point in our
7 putting up any more houses than were needed, but we
8 certainly figure if it were required then we were ready
9 to stand by and supply housing for all the people
10 required.

11 Q Could I refer you then,
12 please, to 3F5 of your application?

13 A Yes.

14 Q And in that section 2.1.1,
15 you talk about your operations head office, and in the
16 second paragraph you say the location, that's of Yellow-
17 knife, "selected, offers the following advantages:
18 suitable living amenities not available elsewhere on the
19 system, requisite to retaining administrative and super-
20 visory staff in the north".

21 Now, if the supervisory staff
22 is already here and are northern residents, can you
23 explain the reason to provide special amenities? It
24 appears to me that this is meant to attract and retain
25 people from southern Canada primarily. Would that be
26 fair to say?

27 A Well yes, that is true.
28 I think there is still you know, the hard core that we
29 would need. For example, gas controllers would be
30 people that would have to be brought in at the initial

1 stages, so it was to attract people like that.

2 Q All right, and is that
3 the same thinking that went into your reasons for choos-
4 ing, say Fort Simpson as your maintenance centre?
5 Greater access and perhaps more amenities than you
6 would find in a community that say wasn't on a road?

7 A Well I think that's true
8 in part, yes.

9 Q Yes, and it's in Fort
10 Simpson too that you spoke in evidence in other panels,
11 of providing some 96 units of housing for your staff
12 at that location?

13 A Yes, I believe 91, I
14 believe.

15 Q I'ts in the 90's, I'll
16 agree with you there.

17 A Yes.

18 Q Now --

19 THE COMMISSIONER: Excuse me.
20 That's what sociologists call the "golf course syndrome",
21 isn't it, to get people to come to work for you, the
22 work has to be in a place where --

23 A Pleasant surroundings, if
24 you will, that type of thing. Yes, sir.

25 MR. BAYLY:

26 Q We could house them at
27 Tuk, then I understand it has a new golf course?

28 A Yes, I heard of it. I
29 haven't had the privilege of playing on that yet.

30 Q Could I refer you then

1 please to 3F6, the next page in the application, and
2 in the paragraph 2.3, "Personnel Requirements", and
3 because I'm interested in your forecast methods of
4 personnel requirements and where they are going to come
5 from, I would like you to explain what you mean by
6 "known socio-economic considerations" in the sentence,
7 "The categories and requirements for personnel are
8 based upon anticipated inspection and maintenance sched-
9 ules, the experience of operating companies, present
10 governmental and industrial work standards, known
11 socio-economic considerations and the environmental
12 effect on maintenance practices and work productivity".

13 A Well I would think that
14 there's been so much work done in the socio-economic
15 field in the Northwest Territories, that I think people
16 are aware of the problems, and I think this is one of
17 the things that we would like to keep updated with and
18 have someone with that specifically on their mind all
19 the time --

20 Q Well --

21 A -- keeping in mind for
22 that.

23 Q I'm just not clear, Mr.
24 Hushion, what you mean by the socio-economic consider-
25 ations in this context. Are you worried that personnel
26 will not stay very long in your operations and main-
27 tenance, or that the living conditions have to be made
28 such that they will attract them, or what does that
29 mean?

30 A I think this pertains

more to the northerner side of it than maybe -- maybe the satisfactory integration of northerners and taking care of those people. I think the personnel counsellor is a type that would be maybe more involved with say the southerner's part of it, but I think the two would have to work in conjunction, one with the other.

Q All right.

A What we are trying to say is to take care of both sides, and the interests of both the best that we can.

1 Q What sort of problems do
2 you anticipate as being unique to people that you hire
3 from the north?

4 A Well not being a socio
5 expert, but I believe a lot of this, the business, the
6 industry, the pipeline itself would be unique to
7 people in the north and I think that they need special
8 consideration to have someone to talk to, to go to
9 with whatever their problems are. These are the ones
10 that would be employed by the pipeline company by
11 Foothills. I think it's that type of thing that we're
12 after. Some sort of counselling, as best we can for
13 them.

14 WITNESS MIROSH: Also a willingness on our
15 part to train people for positions, people from the
16 north for positions in the district offices, head office.

17 Q I appreciate that and
18 I'd like you then to turn to 2.4.1 which is on the
19 next page, 3F-7, and ask you to comment on this as a
20 problem when you're contemplating hiring northern
21 people. Paragraph one states that the applicant recog-
22 nizes the housing support responsibility to employees
23 who are required to reside in communities, remote from
24 major population centres where high cost home ownership
25 will be a financial burden and investment risk. Fre-
26 quent job opportunity transfers will provide reasons for
27 employees to avoid home ownership, and for the applicant
28 to participate in providing accommodation. May I suggest
29 to you Mr Hushion that one of the problems in hiring
30 northerners is that they may not be quite as willing to

1 take the frequent job opportunity transfers that you
2 outline in this section of the application. Have you
3 thought of ways of dealing with that. Some of these
4 people have actual homes here rather than -- I mean homes
5 in the sense that they consider a town or a hamlet their
6 home?

7 WITNESS HUSHION:

8 A Yes, that's quite true
9 but it's not unique to the north. I think it happens
10 in Alberta Gas Trunk Line in our system now, where we
11 would like to transfer someone but we have to consider
12 the person, whether he wishes the transfer, whether he
13 wishes -- if he happens to own a home or -- that he
14 -- you know, some people would move as long as the finan-
15 cial arrangements were all right. Some don't care to
16 move no matter what the financial arrangements are, so
17 in our day to day business operations, we try to take
18 care of the people's interests while we're at it. At
19 the same time when we have a good man that we'd like
20 to have him accept perhaps a higher position, an advance-
21 ment, we would like to make it worth his while so that
22 he may accept the transfer, but you have to look at it
23 from both sides and I think we'd continue to maintain
24 that philosophy.

25 Q So you would be
26 prepared under some circumstances to accommodate your
27 operations and maintenance personnel plans to the fact
28 that you have some people who may not want to be trans-
29 ferred around as readily as someone who doesn't have any
30 roots in the north?

1 A Yes, there's no sense in
2 transferring a person and make him unhappy, then you don't
3 have a good employee, there's not much point in that.

4 WITNESS MIROSH:

5 A There is another element
6 if I could add, and that is on most pipeline companies,
7 there is a job posting system so that employees may wish
8 to transfer themselves if they see an opportunity else-
9 where. For instance someone in Norman may find a
10 position which is more suitable to them at Inuvik. This
11 is posted and circulated and the man may compete with
12 others to take that position. So there is that element.
13 There's the transfer that people want to make.

14 Q Now in this area I note
15 that your main centres are three in the north, Inuvik,
16 Norman Walls and Simpson and I'm excluding Yellowknife
17 for the moment. Do you see a possibility for people
18 working in your operations and maintenance program and
19 not living in those three centres, but living in their
20 own communities in between those centres?

21 WITNESS HUSHION: A Well it does pose an
22 awkward problem.

23 Q Some people consider that
24 Inuvik is not the most attractive place to live, for
25 example.

26 A People from Norman Wells
27 I suppose.

28 Q Yes. So that is a problem
29 you haven't dealt with yet sufficiently to be able to
30 give us an answer on, would that be fair to say?

1 A Yes, I think we wouldn't
2 have a satisfactory answer to that one just now.

3 Q All right, could we expect
4 one by the time we get to say, the socio-economic phase?

5 A I think so. Certainly a
6 lot of the questions that we're discussing here would
7 probably be better answered by people that are more
8 familiar with these particular problems in the Territories

9 Q I'm wondering if this
10 is a concern of people, if you would be willing to
11 direct some effort on your socio-economic-- on the part
12 of your socio-economic staff to this kind of situation?

13 A Certainly we'll note it.
14 yes.

15 Q Now in 242 on the same
16 page, you deal with health services and facilities and
17 from reading that section, it appears as though you would
18 anticipate importing doctors and dentists for the use
19 of your staff and others in the community, is that the
20 proper way of reading that?

21 A I don't think quite to that
22 extent. Mind you, I think its another area of concern,
23 and perhaps more properly dealt with with the socio-
24 panel than with this one. but we realize that by having
25 55, 56 people, or even as many as 90, moving to a communit-
26 ity that maybe has 1,000, 1200 people for example. it
27 creates quite an impact and this is going to have impact
28 on many of the social problems. What we're saying is
29 that realizing that, we would like to work with the
people in the communities and the authorities and try to

1 work out something that is satisfactory to both parties.
2 If we can contribute as good corporate citizens in these
3 communities, we certainly are willing to do so. I think
4 that our track record, as far as Alberta Gas Trunk Line
5 in Alberta, will attest to our attempting to do as many
6 things as we can for a lot of the smaller towns in the
7 province which would be the equivalent to trying to
8 maintain that effort for the communities in the north.

9 Q Would you contemplate
10 then going to the Northern Health service people to find
11 out what kinds of an impact, what kind of impact you would
12 place on their facilities by introducing the numbers you
13 contemplate into the three centres, or the four, including
14 Yellowknife?

15 A Our socio group is
16 attempting to work with these people, to work at this
17 type of problem, realizing its impact.

18 Not being familiar really
19 with too much, it's not particularly our business, so
20 we certainly need a lot of help, although what we're
21 really saying is that we're certainly willing to do as
22 much as we possibly can to accommodate the people.

23 Q Now if we can turn to
24 2.5.1. the next page, 3f8 , the second paragraph
25 refers to the question of the number of qualified northern
26 people that you would perhaps anticipate being available
27 to fill the operations and maintenance positions, but no
28 number is given, and I'm just wondering if you've done
29 some sort of projection at this point as to the number of
people you would contemplate getting from the north, to

1 fill the various positions that you've outlined. I know
2 you can't be exact.

3 A I suppose that's a little
4 difficult at this time, although may I just say that
5 it's a problem that we have in hand with our socio
6 group.

7 Q So we can expect again, by
8 the time that we get to phase four, that there will be
9 some word from Foothills on what sort of percentage of
10 their operations and maintenance staff they would
11 contemplate being able to get from the north.

12 A Yes, we'll investigate that
13 and have that ready for that phase.

14 Q I'm interested in the
15 sorts of things, if you have any information on that
16 that you would contemplate northern residents being
17 able to do from the beginning and perhaps if you were to
18 refer to figure 3f-2.1 you could give us an idea of
19 what positions you would contemplate being filled by
20 northern people. This is the operations and maintenance
21 organization chart.

22 A Mind you, you know we
23 must not forget that we do have the training program
24 under Nortran in which Foothills is a one third parti-
25 cipant now and being involved with training from the
26 very beginning. Some of these positions we would hope
27 that continuing now, and certainly more. increased
28 following certification, that the people that are on
29 here now, there may be more qualified people taken
30 from the north, trained and then could be returned to fill

1 some of these positions. It's really a little difficult
2 in a sense to pinpoint --

3 Q I realize the difficulty
4 in pinpointing things, Mr. Hushion, but certainly if you
5 are involved in a training program, you must have an
6 idea of what the people are being trained to do and
7 they're not being trained, I would assume to do all these
8 jobs because that would involve a tremendously large
9 program, larger than I understand the program is.
10 You don't train somebody to be the manager of gas
11 transmission for example.

12 A Well of course, training
13 for that takes years of experience but you start down.
14 I suppose everyone of us started at some lower level
15 like that and through experience and what not, --
16 this would be the same for people.

17 For example, the welder
18 that's on the Alberta Gas Trunk Line system, which has
19 qualifications to do pipeline welding, certainly could
20 become a district welder at the initial stages. He may
21 wind up to be welding superintendent if we move towards
22 that, the same way that a person that's now running a
23 side boom on our system could become a district super-
24 intendent in short order once he takes an interest in
25 operating a pipeline, so the advancement is there,
26 certainly the opportunities.

27 Q Let's take the example
28 that you were able to start construction tomorrow and
29 open your operations and maintenance program within
30 three years and you would therefore have to say, now what

1 have we got on our own staff and what have we got
2 trained, in the way of personnel to fill the positions
3 that are outlined in figure 3f-2.1 and what can we
4 possibly get from the community of Yellowknife, and per-
5 haps the surrounding communities.

Have you gone into that sort of thing at this point, or have you designed your program, your training program, around that kind of thinking?

A Well I think the training program has not been involved with the actual mechanics of the training program, that is the Nortran, but I know what we were trying to do on our system. I think it's a follow-up of it.

I think they are pointing themselves towards the areas that the northern people could fill in the initial stages, and then knowing full well that by continued experience and additional training, they could advance, but certainly --

Q Well which ones are those, Mr. Hushion? On this chart?

WITNESS MIROSH:

A Perhaps I could help a bit. I understand that the number of the northern trainees have made excellent technicians, working on the Trunk Line system. I don't recall how many but I know I have heard mention of several that are involved in the mechanical and controls technician area.

WITNESS HUSHION:

A There are two fully trained control technicians, and one electrical technician at the present time, sir.

Q So you --

A It's a good example.

Q You would contemplate the

possibility of having at this point, and in a sense this isn't fair to you because it will be later down the line when you would be doing this kind of thing, but you would anticipate having, even at this point, two or three trained technicians by three years down the line?

A Yes, as soon as you get a certificate, of course you would move swiftly then, and there may be a time interval between certification and start of construction certainly operations, so it would be a great time and opportunity then to train willing people.

Q Now, some people will consider that they are already trained for some of these positions, but one of their concerns will be whether Foothills will recognize the training that they have received from, say, the Vocational School at Fort Smith or wherever they have received it, and you have got down on this chart plumbers' apprentices; carpenters; mechanics; welders; electrician trainees, this sort of position, and what I would like to get from you is whether you will be prepared to recognize these sorts of people as employable in these positions, or whether they would have to go through some additional training.

A Well some people would, depending on just which trade you were talking about, but for example a qualified plumber, and certainly he should be hired just immediately, as long as he can do the job, and I'm sure he could.

Q Yes, well there are qualifications and there are qualifications, and what

1 I'm concerned about are whether Foothills is prepared
2 to recognize the qualifications that are obtainable by
3 northern people in the north as qualifications for these
4 jobs, because certainly the people who are my clients
5 are wondering about that.

6 A Most certainly. Certainly,
7 for example, your two examples, a plumber and say a
8 carpenter, that doesn't have to be associated with the
9 pipeline industry as such, so they would be certainly
10 acceptable employees.

11 Q Well let's come at it
12 from the other end. What jobs, trades or whatever you
13 want to call them, do you feel need special training
14 that is not available in the northern schools, and would
15 have to come through your Nortrgn training program or
16 through training which is available only in southern
17 Canada?

18 A Well, some examples would
19 be the controls technicians, because they have to
20 become familiar with the equipment that we would have
21 at the stations, and the same is true of electrical
22 equipment.

23 Mind you, an electrician, for
24 example, is one that could easily pick up -- he can
25 tend to any electrical equipment in very short time.
26 He just has to learn the specific equipment, so it's one
27 that is easily solved. People on the maintenance crews,
28 measurement technicians is another one. This is more
29 certainly a specific type of qualification, not only
30 for the instruments which is not normal, except in our

1 own particular industry. They would take quite specific
2 training.

3 In the pipeline area, someone
4 torun a side boom or big dozer, but there are people
5 running dozers in other businesses, moving dirt or what-
6 ever, that could be qualified. The only thing, and I
7 think Mr. Kosten pointed this out yesterday, is the
8 transition from that to handling the pipe, but this is,
9 you know, you run the dozer, you can learn the other in
10 a short time. It's a matter of giving the opportunity
11 and experience.

12 The same is true of back hoe
13 or crane or drag line.

14 Q That's then the company's
15 feeling about this. The other concern that I have, and
16 you may have some information on this, is that certain
17 jobs require not from the company, but from the unions
18 to which the employees generally have to belong, certain
19 qualifications, that may be available in the south but
20 may not be available to people here in the north.

21 For example, a man -- using
22 your example, may have been driving a bulldozer which
23 he learned to operate on a DEW line site and operates
24 it quite competently, but he doesn't have whatever the
25 grade level education that the union recognizes as
26 being essential to understand the operation of a bull-
27 dozer. Now, that's a dilemma, and what sort of obser-
28 vations do you have about that?

29 A Well it certainly is a
30 dilemma, and it's one that we recognize too and have to

1 contend with that. I think that we need to have some
2 assistance and some understanding from the unions in
3 this particular problem.

4 Q Well have you approached
5 the unions to achieve this kind of understanding or to
6 even discuss it yet?

7 A No, we haven't done that
8 as yet, but it certainly is on our agenda, yes.

9 Q All right, and when you
10 say it's on your agenda, where is it on your agenda?
11 When will we know that there's been some communication
12 with the unions about this and their reaction to it?

13 A Well, I don't know how to
14 put a time element on it.

15 Q I don't mean a day, but
16 I would just like to know because I'm concerned that
17 these things may be left until after the Inquiry, and
18 I don't want the Inquiry not to at least be able to
19 confront these problems.

20 A Well we certainly hope to
21 do it soon, and mind you, there are numerous trades, four
22 specific ones in our particular industry, but it takes
23 sometime to get to all these people, but let me say we
24 would start discussions with them very shortly.

25 MR. BAYLY: Fine, those are all
26 the questions I have, sir. Thank you, gentlemen.

27 THE COMMISSIONER: Well, we
28 will stop for coffee now.

1 (PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

2 CROSS-EXAMINATION BY MR. SCOTT:

3 Q Mr. Mirosh, I'm glad you're
4 on the panel, I can continue where we left off yester-
5 day. While you're here, I've been advised that one of the
6 proprietors of Foothills, Westcoast Transmission have
7 filed an application to build 140 miles of pipeline
8 to Fort Nelson, British Columbia, and that the pipeline
9 is, as I say, 140 miles long, it has no compressor
10 stations, in that 140 miles though I think one is
11 potential. It's a 30 inch diameter line, it's wall
12 thickness is .375 and it's grade 70 pipe --

13 THE COMMISSIONER:

14 Would you repeat what you just
15 said about this pipeline.

16 MR. SCOTT: I'm instructed that
17 Westcoast has applied to build 140 miles of pipe to
18 Fort Nelson, B.C. I presume on their main line, adjacent
19 to their mainline. There is to be no compressor station
20 on the line, that is within the 140 miles, though there
21 is some suggestion that one may subsequently be added.
22 The diameter of the pipe, I'm advised is 30 inches, it's
23 grade 70, it's wall thickness is .375 and it's going to
24 operate under 1250 PSI. Now the interesting thing
25 about that application is that, I gather, because there
26 will be no compressor stations, it is contemplated that
27 the pressure will reduce over the length of the line,
28 for some reason that doesn't concern you at the moment.
29 But the interesting thing about it is that part of the
30 plans include ten block valves on that 140 mile line.

1 I wonder if, you may not be familiar with it today, but
2 if you could inquire for us and determine the virtues of
3 the block lines in your company's application at that
4 location and compare them to your assertion that they
5 are unnecessary in the Northwest Territories.

6 WITNESS MIROSH: A Yes I can inquire into
7 that. I imagine that Westcoast as a matter of policy,
8 has block valves. probably for looping considerations
9 as well as others.

10 Q I would be interested in
11 your rationalization because Westcoast is as we gather,
12 a substantial proprietor of this applicant and I wouldn't
13 have thought they would adopt a policy in one province
14 that was justifiable that they wouldn't want to advance
15 in the Territories.

16 Mr. Hushion, I was taken by
17 your -- in your transcription, by your observation that
18 the Foothills project compared to Arctic Gas in the
19 Territories, is a modest one and that that, as you
20 stated, has certain ramifications. Leaving aside the
21 diameter of the pipe about which we've all heard plenty.
22 I worked out the mileages and we have calculated that
23 including laterals to communities, there is approximately
24 1400 miles of pipe within the Territory for Foothills
25 and I take it that that would be very close.
26 We came to 1392 miles of pipe.

27 WITNESS HUSHION:

28 A Yes.

29 Q That was the general
30 figure was it?

1 A Yes

2 Q Now if you leave out the
3 Prudhoe Bay lateral and I understand your view that that
4 can't be done, but if you leave it out, our calculation
5 is that Arctic Gas has 850 miles of pipe, you wouldn't
6 disagree with that figure, would you?

7 A That may be close, yes
8 I'm not sure of the leg across from Prudhoe Bay.

9 Q And that even if you
10 add in the Prudhoe Bay lateral, depending on whether
11 you go on the Arctic Coast --

12 THE COMMISSIONER: What was
13 the first figure?

14 MR. SCOTT: 1392.

15 THE COMMISSIONER: What's your
16 next figure?

17 MR. SCOTT: 850 Arctic Gas
18 leaving out the Alaska connection.

19 THE COMMISSIONER: That's north
20 of 60.

21 MR. SCOTT: North of 60.

22 Q But that if you add in
23 the Alaska connection, depending on whether they go the
24 Arctic coast route or the interior route, it comes to
25 approximately 1,150 miles.

26 THE COMMISSIONER: Is that the
27 coastal route?

28 MR. SCOTT: That's the interior
29 route. And I understand that it, in fact, is longer than
30 the coastal route.

1 I'm sorry that is the coastal
2 route. The interior route is 1,090 miles.

3 THE COMMISSIONER: 1,090.

4 MR. SCOTT: And 90.

5 Q Now, it's clear is it
6 not that therefore, Foothills will be laying more pipe
7 and in that sense is a more substantial project than
8 Arctic Gas' in that sense alone?

9 A Well in terms of pipe,
10 I suppose in terms of usefulness.

11 Q Oh, it may not be a
12 useful pipe, I leave that to you and Mr. Gibbs and Mr.
13 Genest to deal with, but in terms of miles of right of
14 way, Foothills is a larger project.

15 A Yes, this is right, by
16 mileage .

17 Q Then I was also interested
18 in your observation, and it began to sound a bit, if I
19 may respectfully say so, like Mr. Horte who told us that
20 -- I'm not sure that he told us, but he said that
21 only 40 acres was involved in the pipeline -- 40 square
22 miles were involved in the pipeline, but in your evidence
23 you say that --

24 THE COMMISSIONER: What's that
25 again?

26 MR. SCOTT: Mr. Horte made
27 an observation in some speech that the pipeline, the
28 Arctic Gas Pipeline would occupy only 40 square miles.
29 I raise the question because you say on page number four,
30 that Foothills would have to maintain only 600 acres as

opposed to 5,000 acres for Arctic Gas?

Now I'd like to --

A We were excluding the right-of-way.

Q You were what?

A Excluding the right of way.

Q In both cases?

A Yes.

Q Yes. Well let me ask you about that.

THE COMMISSIONER: Let me ask you about it first. If you exclude the right-of-way, what permanent facilities are you talking about, that occupy 600 acres in your case, 5,000 acres in the case of Arctic Gas?

A That involves the roads and compressor stations. meter stations, O and M facilities.

Q By roads you mean access roads?

A Access roads, yes. And of course, the airstrips in the case of Arctic Gas.

Q What is it that makes a big difference, the airstrips?

A The airtrips primarily.

Q And do the 5,000 acres --

A Excuse me sir, there's also a difference in the compressor stations, it's 11 to 25.

Q I understand that. Does the 5000 acres convert to 40 square miles?

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Would you have to add in the right-of-way itself? Well maybe somebody can enlighten me on that.

A If I remember correctly, I think it's something like 6,000 acres for the right-of-way for us, and about 12,000 for Arctic Gas, does that sound --

MR. HOLLINGWORTH: A square mile is 640 acres, sir, is that is any assistance to you.

MR. SCOTT:

Q Well let's just take the right-of-way if we may. Mr. Hushion, let's just take the right-of-way, if we may. You say you're using 6,000 for the right-of-way and Arctic Gas is using 12,000, but you're, to be fair, only counting your 60 feet?

A Yes, that is correct.

Q Yes, and in fact you are going to utilize and as other panels have told us, be responsible for 120 feet?

A That's right. We made no point of that Mr. Scott, though, we excluded the right-of-way.

Q All right, but in terms of right-of-way, you will be using and occupying, because you have more miles, substantially more than Arctic Gas?

A Yes, but it's a lot more difficult terrain as far as the leg from Prudhoe Bay to Travaillant Lake, than there is across -- in the

1 Yellowknife lateral.

2 Q I am just troubled by this
3 observation that you're dwarfed by Arctic Gas in terms
4 of land usage, and I put it to you that in terms of
5 right-of-way and construction space which you will clear,
6 you will obviously take substantially more land than
7 they will, because you are longer, and you are going to
8 utilize the same 120 feet?

9 A Yes, we recognize that.

10 Q All right. Well now, when
11 we come to the comparison of 600 acres to 5,000 acres,
12 have you included borrow pits in that?

13 A Well I'm uncertain as to
14 whether borrow pits are in that or not.

15 Q Well if you included
16 borrow pits, if you did, --

17 A I think we assume that
18 maintenance of borrow pits is after construction these
19 have been attended to, and left in satisfactory con-
20 dition.

21 Q But if you included borrow
22 pits, your information on the number of borrow pits you
23 would require, would be I take it no better or more
24 precise than the evidence that was given yesterday?

25 A That's right.

26 WITNESS MIROSH:

27 A Sir, we have a figure for
28 borrow pits in the location section, which is, for the
29 construction phase, borrow area sites, some 2,900 acres.

30 Q The point I was making,

perhaps is not clear. I take it whatever figure is contained in the application, the precise information and knowledge as to borrow requirements, is no better in this panel than the evidence that was given by yesterday's panel. They're the people who would know about the borrow requirements?

A Well the borrow sites are shown on our alignment sheets, and are on our construction drawings.

Q All right. Well, have you included in your 500 acres, the Shoo-fly roads that are shown on your alignment sheets?

A We have an item in the location section which shows the acreage required for that, sir.

Q For all the Shoo-fly roads?

A Yes, the number we have put in the application is some 1,100 acres

Q So we better just add 1,100 to your 600?

A Well that number would have to be added to any project in that area, a number like that.

Q All right, but you have included access roads, as I understand, in your assessment of Arctic Gas' acreage?

A Well there are other access roads to the stations and so on, yes.

Q Well I am just troubled

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1 about this, because this of course is part of the record,
2 and I just want to be sure that we have everything
3 included. So your estimate for Shoo-fly roads is 1,100
4 acres.

5 Now, you have also included in
6 Arctic Gas' 5,000 acres, I presume, space that will be
7 required to build and utilize wharves?

8 A I suspect that would be
9 in there if Arctic Gas is intending on utilizing these
10 wharves during the operations phase, yes.

11 Q Well now you are going to
12 have portable wharves during the operations phase,
13 aren't you?

14 A Yes, well our portable
15 wharves during construction and --

16 Q And maintenance. It's in
17 your evidence.

18 A Yes, they will be available
19 if we have to put them into the --

20 Q Well how much acreage have
21 you allowed for them in this 600 acres?

22 A Well during the construct-
23 ion phase, we have an acreage which again we have
24 published in the location section, which I am just trying
25 to find. The total staging areas, which would include
26 all of the wharves along the Mackenzie River, we have
27 stated as some 690 acres for construction.

28 Q Well what I am trying to
29 find, Mr. Mirosh, is how much have you allowed, if any,
30 in the 600 acres, for maintenance wharves?

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A I suspect from the numbers I have here, that we may not have allowed anything except to the extent that the wharves' clearing areas will be there. They will be reclaimed and will be available for re-use if we need them.

Q No, but if you are going to make this acreage comparison, if you charge Arctic Gas with wharf space, you have got to charge yourselves for it, don't you, if the comparison is to be just?

A Yes.

Q Or is it the portable feature that leads you not to make the comparison, that you can just by night pull it up on a beach and be off the next day?

A Well we don't anticipate utilizing these wharves significantly for O & M.

Q All right. Well I suggest to you, respectfully, that the comparison between 600 acres and 5,000 acres is not a meaningful one, in view of some of the matters that you have not included in your acreage, which you have included in Arctic Gas' acreage. Isn't that fair?

A Yes, I guess one of the problems is we don't have in front of us what goes into those two numbers at the present time.

Q Well let's take one other thing that is important. You told us yesterday that you recognized that the Mackenzie Highway only goes 30 miles beyond Fort Simpson and may go to Wrigley. You say in your evidence today that in maintenance you are

1 going to depend on a highway with helicopter support.

2 Now, what is this highway?

3 A Well it's a very elusive
4 highway, I guess.

5 Q Well let's assume for the
6 moment that there is going to be no Mackenzie Highway,
7 and your program calls for reliance on a highway with
8 helicopter support.

9 A Yes.

10 Q Now, what are you going
11 to do in the winter? Are we back to the Inuvik snow
12 road?

13 A Yes, that's certainly
14 there in terms of cleared right-of-way and grade require-
15 ments and only requires preparation.

16 Q Well in the summer what
17 are you going to do? Assuming you induce somebody to
18 build this snow road to Inuvik or you do it yourselves,
19 that may take care of the winter.

20 A Yes.

21 Q What are you going to do
22 in the summer?

23 A Under the assumption that
24 we do or do not have a Mackenzie Highway?

25 Q On the assumption that you
26 don't.

27 A We would have to rely on
28 helicopter transport as we do during the construction
29 phase.

30 Q So do I understand then

1 that in the summer months, that is in that period of the
2 year when the snow road to Inuvik is not usable, you
3 will not be depending on any roads for practical
4 purposes, but will be relying exclusively on helicopters?

A Yes, there are areas that we may be able to get into, for instance around Inuvik, we have shown on our application an access road into a station there, and stations close to other communities, but there will be isolated stations if there is not a Mackenzie Highway, and if you are considering the summer time.

Q And there's just in that connection one thing I want to lay to rest, if I have it right. I got the impression, I think it was mistaken, that in the summer you would be utilizing the right-of-way as a highway or as a roadway, and I take that that in fact is not your intention?

A Well with low ground pressure vehicles, this may be required from time to time.

Q But I take it that you're not -- understandably you will travel on the right-of-way when you move from a compressor station to some place on the adjacent line, I understand that. But I take it that you don't intend to use the right-of-way for any transportation of goods or men or services beyond that?

A No, we would depend on helicopters in the summer time.

Q Well now, have you -- has

1 has the panel or any member of it read Arctic Gas'
2 evidence or their application with respect to the follow-
3 ing matters: Start-up procedures, monitoring procedures,
4 maintenance procedures, contingency plans and closure
5 and abandonment. Are you generally familiar with what
6 they propose in that area?

WITNESS HUSHION:

A Well we have read it.

Q Well let me ask you this.
8 Are there any significant differences between their
9 approach in those areas and yours?

A I would think the general
12 approaches are much similar. Most of the work was done
13 by the same person.

Q Well that's what I was
15 going to get at. Would it be fair to say that the main-
16 tenance proposals have been done for both applicants by
17 a single individual or firm?

A Pretty well. Mr. Paul,
19 who is one of our employees, was on loan, when we were
20 part of the study group for two years in creating --

Q So it's really your main-
23 tenance plan that they've taken, rather than you're
24 taking their maintenance?

A That's the point.

Q I see. But there is no
27 significant difference of which you are aware at the
28 present time in those areas?

A Well a few modes of

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1 operation there that we have been discussing. Beyond
2 that, I think they are --

Q All right. Well now just
4 to have it clear, I take it that Foothills accepts the
6 long-term responsibility for the care and maintenance
of 120 feet, or whatever portion of that may have been
7 cleared or used?

8 A Yes, whatever portion we
9 would actually use we would feel responsible for main-
10 taining that.

11 Q And that's so, regardless
12 of the legal basis on which you may hold it or use it?

A Whatever portion of the
4 line that we have used during construction phase, and
5 we would maintain and feel responsible for, yes.

Q And I take it that that
7 means, in maintenance terms, that you will monitor the
8 performance of all land used by you, up to 120 feet or
9 beyond if it's used, and that you undertake to make
10 any necessary repairs or undertake rehabilitation
11 techniques in that area, if they be necessary?

1 A Within the ^{areas} utilized by us
2 for construction, yes.

3 Q Now in Section 3F of your
4 application, you refer to manuals of procedure. Has
5 anything been done to prepare these manuals of maintenance
6 procedure or is it too early?

7 A It's too early for that
8 sir. We need a lot of information to put into those.

9 Q Who would be charged
10 with preparing those?

11 A Well in the future Mr.
12 Littledale. This is one of his important tasks.

13 Q Let me ask you this,
14 about the Mackenzie Highway, have you made any represen-
15 tations to government or to the department, as to whether
16 the highway should be completed or beyond its present
17 location?

18 A Yes, sometime back we
19 suggested that it would be in our interests to have the
20 highway completed. We felt that the use of an all-
21 weather road would certainly enhance both construction
22 and operation.

23 Q Would it be fair to say
24 having seen your construction program and your maintenance
25 program, that Foothills has an interest in the completion
26 of the highway or at least the extension of it sub-
27 stantially?

28 A No. not an interest in it
29 as such. I think it would be an advantage if it were
30 there, but if it's not to be there, then we propose to

1 construct and operate without it.

2 Q I understand if it's
3 not there you're not going to pack up your bags and go
4 home, but wouldn't it be fair to say that you have an
5 affirmative interest in its completion? It's part of
6 your first line plan. You have a back-up plan, but
7 it's part of your first line plans?

8 A Not necessarily, but
9 I think as we said if it were there, then it's advantag-
10 eous to the pipeline so we should look down the road that
11 it will be completed eventually someday.

12 Q Now, I ask everybody about
13 the highway and no one will say that they want it. I take
14 it that you do not intend, the development of a more or
15 less continuous roadway along the right of way, we're clear
16 about that?

17 A Yes it won't be a right of
18 way, but it will be a road that -- not a road rather
19 but an area that could be traversed by low ground
20 pressure vehicles. It is not a roadway per se.

21 Q No, but have I got it
22 clear that the right of way is going to be used to
23 move out from a compressor station to some site where
24 work requires to be done but you're not going to turn the
25 right of way into any kind of transportation corridor?

26 A That is correct, yes.
27 It's only to be used when necessary.

28 Q But not for transporting
29 things, for example, from compressor station to com-
30 pressor station.

A No, that's right.

Not unless there was a specific requirement that we
needed---

Q That's what your using
the helicopter for ---

A Pardon me?

Q If you have to transport
a load from compressor station one to compressor station
two, I understand it's your proposition that in the
winter you'll use the winter road, and in the summer
you'll use a helicopter.

A Yes, or we would traverse
other areas by low ground pressure vehicles too but we
would try to stay off the right-of-way unless it was
necessary.

Q What land off the right
of way are you going to use?

A Well there are other cut
lines that you could traverse there would be access roads
or numerous clearings, things like that.

Q Well that seems to suggest
that you're not going to rely to the extent I thought
you were, on helicopters, that you're going to develop
either on the right-of-way as I feared or off the right
of way some kind-of-road system.

A Only one that's there, we're
not going to create something in order to do this, but
if it's possible to get from here to there by some road
that we're allowed to traverse on, well it would seem
wrong not to use it.

1 Q Well of course, you're
2 going to use existing roads, wherever they may be. that's
3 obvious and sensible, but apart from that, you are going
4 to use helicopters except when it is necessary to go
5 from a compressor station to some area before the next
6 compressor station?

7 A That's right, yes.

8 THE COMMISSIONER: Mr.
9 Hushion, are you concerned that if your company were to
10 proceed on the basis that the Mackenzie Highway completed
11 to the Arctic, was an integral part of your program for
12 constructing the pipeline, are you concerned that if
13 you were to take that position, then it might be urged
14 that you should be required to pay for it, as a condition
15 of proceeding with the construction of the pipeline?
16 Has that factor gone into your company's deliberations
17 in deciding what stance to adopt with respect to the
18 highway?

19 A We've thought of that,
20 and sometime we were looking at this at the time when the
21 highway was being worked on, and at that time being
22 extended. We looked at some of the economics on it and
23 felt that with the highway there would be a savings to
24 the project. And we thought amongst ourselves that
25 perhaps if there is a saving to us, maybe it's something
26 that might be contributable to the extension of the high-
27 way if it were desired and warranted. We didn't
28 proceed beyond that. We felt all along that the use
29 of a highway of course, would be of assistance to any
30 project for that matter, to the pipeline.

1 So that we had an interest in
2 seeing that it was built. And if we could save some
3 money, which I recall that we did, I've forgotten the
number, it was in the 20 to 30 million, 22 million
dollars I'm told.

6 Q Twenty-two million, you
could have saved 22 million if the highway had been built?

8 A That is right, yes.
9 So that it had an advantage to the pipeline and at that
10 time people were saying that it had an advantage in the
11 North. I understand that there are people that don't
12 wish it, so I don't want to get into that. But from our
13 point of view, anyway, it had an advantage.

14 MR. SCOTT:

15 Q At 3F3 where you deal
16 with this matter you set out your assumptions and the
17 first assumption is an allweather Mackenzie Highway
18 and we've dealt with that assumption for the moment.
19 The second assumption is that the gas plant operators
20 will have all weather roads from Inuvik to their plant
21 sites prior to start up. I take it that that mean
22 a highway from Inuvik out to the Peninsula. And your
23 assumption is that there will be a road there that you can
24 utilize, all weather?

25 A Yes, that would get us to
26 our meter station at the plant outlet.

27 Q Are you aware that the
28 gas plant proposals as presently formulated, disavow
29 an all weather road and rely exclusively, from what I
30 can judge on a STOL airstrip and a jet airstrip.

1 In other words, they tell us,
2 that leaving aside your first assumption about the
3 Mackenzie Highway, they tell us that your second assumption
4 isn't going to happen as far as they're concerned.

5 THE COMMISSIONER: You mean the producers
6 tell us.

7 Q Right.

8 THE COMMISSIONER: Gulf, Shell, Imperial?

9 Q Yes.

10 A Well I'm sure that's
11 possible. I imagine the producers in their thinking,
12 they can change their plans today to tomorrow also
13 we just have to stay abreast of them.

14 Q I understand --

15 A At the time that was
16 what we understood.

17 Q I understand that, but
18 you presented us with is a proposal that is based on
19 two assumptions, the Mackenzie Highway and an Inuvik
20 Gas Plant Highway, which are effectively disavowed by
21 everybody. The relevant authorities, the gas producers
22 and the government, indicate it's not going to happen
23 in the measureable future.

24 A We're not necessarily
25 counting on the Mackenzie Highway now.

26 Q Well are you counting o
27 on this road from Inuvik. It's one of your assumptions?

28 A To the producers plants
29 you mean?

30 Q Yes.

A Yes, apparently it was.

Q Well what are you going to do if, as the producers tell us, it's not going to be there.

A We'll have to readjust our plans then now. I'm sure at the time we thought that was what they would do.

Q I see.

WITNESS MIROSH:

A At the time, chronologically that we were preparing this application, the highway was still in a state of flux. And from our conversations with the Department of Public Works, this extension of the highway up to the producer plants was in their thinking. Now, things have obviously changed, in the interim, but by the virtue of a STOL strip being in the producers plans, I'm certain that accommodation can be made to the pipeline company to utilize that facility.

Q You see that's why I thought that I could perhaps -- perhaps it was too optimistic, but get you to agree with me that you have a positive interest in proving out these two assumptions That you want a highway and that you want a road to the gas plants. Isn't that what it is, that you're in favour of those things.

WITNESS HUSHION.

A We want to get to the gas plant of course but it seems to us that we should use common facilities in order to maintain good liaisons for one thing and reduce the cost while we're at it.

Q All right.

A This happens quite frequently in Alberta where we have -- we connect to many plants and we have common electrical facilities, common communication facilities, and we use common roads and get together to share the costs. So it's a logical thing for us to proceed on.

Q You refer in your application and in your organization chart, Figure 3F2.1, to environmental and right-of-way engineers who will be attached to the head office in Yellowknife, and the district headquarters at Inuvik, Norman Wells and Fort Simpson.

Now, are we talking about one person in each of the district headquarters?

WITNESS MIROSH:

A I think there is a table that shows manpower requirements later on, which indicates one person at each.

Q All right. Well now, what qualifications is it anticipated that these people will have?

WITNESS HUSHION:

A Well we will have a lot more people involved with the construction than would remain with the company when we go into operations, so I think that we would assess the best available ones then and those would be the people that we would hire. I think it's more a problem of getting people for construction with the correct qualifications. It's a little difficult to know just what's available in that field.

Q Well the expression "environmental engineer" contemplates in my mind, either let us say, a biologist or an engineer. I'm not sure that in unique personalities the capacities are always well combined. What is contemplated here? Are we

1 talking about an environmental specialist, or are we
2 talking about an engineer who will have some environ-
mental knowledge?

4 A Well he doesn't necessarily
have to be an engineer. Maybe it's preferable, he might
be see things from both points of view if it's possible.
It's a difficult problem, and I think many companies are
faced with this. You're trying to get an all-encompass-
ing person to know and understand the different
biologies, if you will --

1 Q So I take it --

12 A -- plus some geotechnical.

14 Q Yes. Well what specialist
advice is going to be available to these chaps at the
district headquarters?

16 A Well I would expect that
they would maintain quite an upkeep in environmental
knowledge, by trying to be as versatile as they possibly
can, but I think that in an operating company we would
allow them access to various consultants if they needed,
on the particular area that they are looking after, so
that they could know and understand the site specific
areas.

I need to have a fish biologist
in Great Bear, and I really want to know that, but this
person's help isn't that qualified as a fish biologist,
I would hope that he would -- and certainly we would
plan it that way, that he would obtain as much knowledge
from an outside person. This would be the type of thing
that we would hope would eventually get into our

1 procedures manual.

2 Q Well let's see if your plan
3 then is like the Arctic Gas plan, as I understand it.
4 I understand at their headquarters in remote Calgary,
5 they will maintain a staff which will have the complete
6 range of environmental specialists, from fish men to
7 mammologists and vegetations people. During the main-
8 tenance of the program, of the pipeline, and that that
9 staff, which will be environmentally oriented, that is
10 not primarily engineering, will be available to advise
11 their maintenance people on the ground. Are you going to
12 do that?

13 A Well Mr. Mirosh was
14 mentioning yesterday in the construction phase that we
15 would have these people at head office. It may be that
16 we would be wise to have that available to us more
17 direct than to outside consultants. It's a matter of
18 choice as to whether you think it's better to have such
19 a person on staff with you or to call for specific
20 requirements.

21 It's so broad that --

22 Q Have you made that choice
23 yet, as between the two alternatives?

24 A No, I don't think we have,
25 and I think that it's not proper to make the choice at
26 this time. I think we would know so much after we had
27 gone through construction and the people that are avail-
28 able to make it then, and probably make it more
29 properly.

30 Q Well in your application,

1 Section 3F5.4, you make reference to the maintenance
aspects of weed and vegetation control with respect to
3 the right-of-way. Have you got beyond that in terms of
4 techniques?

5 A No sir, I think this is
6 another log that we need to get, we need during con-
struction and the knowledge that we would pick up from
8 that once again to add to our manuals.

9 Q In short, you haven't
10 determined whether chemical controls will or will not be
11 used?

12 A Well there may be certain
13 things that we could say yes to in cases like that, but
14 I think in the overall that you would need to be very
15 site specific in what we are talking about.

16 Q Well the issue of chemical
17 controls can be an important environmental consideration,
18 especially the extent to which some things are not known
19 about their side effects, and what concerns me is have
20 you made the decision that you will be utilizing chemical
21 controls, or is that something that remains to be
22 evaluated in the future?

23 A Well I think that's some-
24 thing that remains to be evaluated.

25 Q Well now, with respect to
26 maintenance I would like to get from you, and perhaps it
27 is in the application and I simply haven't been able to
28 put my finger on it, your expected long-term requirement
29 for barges and wharves in two eventualities: First,
with the Mackenzie Highway and secondly, without a

Mackenzie Highway. First of all, let's deal with a Mackenzie Highway. To what extent will you require barges and wharves, and what numbers have you?

WITNESS MIROSH:

A For operation and maintenance or construction?

Q Operations and maintenance.

A Well we haven't visualized any requirements beyond the construction phase.

Q Well do I understand that to be, therefore, that at this stage you can't tell us to what extent you will need wharves in maintenance, and you can't tell us to what extent you will utilize barges in maintenance?

A Yes, there are possible uses for maintenance, such as obtaining borrow from the mouths of certain rivers, and perhaps barging this borrow, but that's something we haven't really planned on. These are possible uses.

There's no major material movement involved after construction.

Q Well what concerns me is if and when evidence is led as to barge traffic, and the effects on it of the completion of the pipeline, that is during its maintenance phase, I take it that you are not at the present time able to tell us, to what extent, if at all, in maintenance you will require either barges or wharves?

A Oh, we can't foresee any significant requirement, other than that which could be

1 provided by the existing operators with their then
2 existing fleets.

3 Q Well let's go at it
4 another way. For the purposes of re-supplying your
5 district offices, during O & M, during operation and
6 maintenance, what is your estimate of the annual tonnage
7 that will be brought in?

8 A We don't have a number that
9 we can give you right now.

10 The tonnage, though, is insig-
11 nificant compared to what we were talking about for
12 construction.

13 Q Well I thought that, but
14 are you able to give us any guesstimate as to what your
15 annual tonnage will be in O & M?

16 A No, the only things would
17 be fuels and oils and lubricants, spare parts, generally
18 would be very small.

19 Q Can you give me a figure,
20 within 15 tons?

21 A No, we would have to cal-
22 culate that, but we can --

23 Q Could you calculate that
24 for us without too much trouble?

25 A Well not here, we would
26 have to do that back in the office.

27 Q I understand that, perhaps
28 you could let Mr. Hollingworth know when you have made
29 that calculation?

30 A Yes.

WITNESS HUSHION:

A I think the point is that we are hoping and planning to use winter roads as much, and schedule that type of movement of materials in the winter and at the proper times.

Q Well whether the winter roads are used or barges are used, I just want to get some assessment, because we are measuring impacts over the long term, of the traffic that will be generated during the operation and maintenance phase.

A I think what we are saying is we think that would be a very reduced amount, and that is why we are using portable wharves.

Q Well I would still like to have your estimate.

A We will give you some guesstimate, if we can, of it for the future.

Q Well now, are you going to use -- and this question perhaps should apply to construction as well as to maintenance, and I should have asked it yesterday and perhaps you can help me. Are you going to use the winter road between Fort Nelson and Fort Simpson?

WITNESS MIROSH:

A Well we may, we haven't planned on -- we haven't mapped any logistics across it at the present time, but certainly that winter road and others which may exist interconnecting across B.C. and the Yukon and Northwest Territories could be used if we have logistics movements in that direction.

Q Well then do I understand that it may be used during maintenance as well as construction, for the purpose of bringing things into Fort Simpson?

A Well it may be used in the sense that any other available transportation means may be used. The best one would be used at the time.

Q This is a question that is triggered by curiosity, as much as anything else, but I am advised that at Westcoast Transmission Company's main line across the Fraser River near Hope, British Columbia, there is at the station, a 24 hour guard armed with dogs. If that is so, is there some peculiar risk there that will not be existing in the Territories?

1 WITNESS LITTLEDALÉ:

2 A Could I answer that?

At the Flood, which is Flood crossing, the aerial crossing, just downstream of Hope, the aerial crossing drops down and enters the ground on either side, and it is in these areas that we have fenced off where the pipeline comes in and where the structure that supports the pipeline is anchored and we have within these two compounds so to speak, guard dogs, and we have a watchman who is not armed and never has been. The reason for this precaution it started back in the time when there was trouble in the Okanagan Valley with the Doukhobor sect who were dynamiting various structures, and upon advice of the authorities we did take special precautions in this area to try to safeguard it.

Subsequently we've put another crossing across the Fraser which is a submarine crossing; so the aerial crossing at Flood does not have the same importance as it did prior to that second crossing being installed earlier this year, and it is now sort of a matter of judgment as to whether we should keep the guard, the watchman there, with the dogs or release him. In this matter we will be guided by the advice of the authorities.

Q Well I take it that none of that is contemplated up here is it? That some religious sect should --

WITNESS MIROSH.

A No, we don't have guard dogs in our plans.

Q Now in the design panel and perhaps the question has been answered, we were referred to O & M when we asked what compressor stations would be totally dependent on helicopter access and do I understand that we now have the answer, that is north of the highway, in the absence of winter roads, the compressor stations will be totally dependent on helicopter access?

A I believe the station near Inuvik did have plans for an all weather road, which would still be the same plans, and there might be other locations like that but I can't recall, but generally speaking, north of the furthest extent of the highway at the time that we go into operations, would be the remote stations.

Q Well with that reservation do I understand that in the non winter season, each compressor station will be virtually dependent on helicopter access north of the highway?

A Yes except for the instances where we had planned before and we would still continue to plan access roads from communities which are near the compressor stations, for maintenance.

Q Just one other question and I'll be finished. In your application part 3F, you say and I'll just read the relevant portions to you, "The eventual goal is to enable metering compressor stations to operate unattended for significant periods of the day or week. It is intended that this goal will be achieved gradually over the first several years of system

development, on site experience and staff training.

Well now, are you able to give any more precise estimate as to when the stations, both meter and compressor, will be unattended? Is it two years, three years, five years?

WITNESS HUSHION:

A It's pretty difficult to really pinpoint a number to it. It depends on the sophistication of the equipment and how it works. We've managed to put on some stations in Alberta Gas Trunk Line System in very short order. It can be anywhere from a couple of months of running time to some that we still have people at.

Q After how many years?

A Well some by decision. You have employees and you find that they just-- well maybe an electrician takes care of it eventually, but you have them there and you might as well keep them at a station and operating it, but it isn't necessary to have them there.

Q I'm sorry.

A If I could continue on for just a moment. In finally getting them to remote a stage, it depends on perhaps the operators maybe it might take a little bit longer. if we were trying to be sure that we had some northerners trained as controls technicians for example, we may leave them there a longer time, and take it more slowly.

Q Well would it be fair then going at it another way, to contemplate that for most of the stations, perhaps not all, but for most of the

1 stations, there will be let us say a two to four year
2 period in which they will continue to be manned after
3 construction has been completed?

4 A It could go to that length
5 of time, but it doesn't necessarily have to be so.

6 Q Well now, once the
7 stations are unmanned, and leaving aside an unusual
8 problem, have you any estimate of how many inspection
9 or maintenance trips are likely to be made over any
10 given period? Perhaps your Alberta experience will be
11 of some help here. How often do you have to go in to
12 an unmanned station?

13 A It just depends on the
14 specific stations. Sometimes you have some instruments,
15 some relays that are crankier than others, that give
16 you trouble, until you solve this but --

17 Q Well what's regarded as
18 normal? Surely in costing your operation, you must have
19 to plan for a -- in general terms for a standard number
20 of trips so that you can gauge whether the station is
21 giving you more trouble than not?

22 A You know when it's
23 giving you any more trouble or not, but it's more
24 caretaker duties, you're going by, if some are close by,
25 you know, you'd go every day to them and just be there
26 during the day and --

27 Q Well what is your estimate --

28 A -- very attendant duties.

29 Q What is your estimate in
30 the Territories for the number of trips you will be

1 required to make to an unmanned station?

2 Are we talking about one a week or one a day, as you
3 suggested or one a month?

4 A Well I think you can
5 go from one a day to one a week and it's a matter of
6 wheeling yourself on the requirements, and even at
7 that, as I say, the people are there, it's better off
8 that they be around the station and learning something,
9 being more familiar with the equipment than sitting in
10 head office reading a magazine type of thing, so we
11 would continue to take them out there and let them be
12 there during the day.

13 Q So would I be right in
14 concluding from that that after the station becomes
15 unmanned, we must contemplate the possibility that at
16 some, if not all of them, there may be several trips
17 a week?

18 A Yes, there could be, but
19 supposing you're having some problem at one station,
20 you may take the people and spend more of your time there
21 and say, well we know the others ^{all right} and ignore it for
22 days or weeks.

23 Q But in short the personnel
24 as you've said, as you've allocated for the district
25 offices, are not in your judgment, prudently used if
26 they sit around the district office, that you will be
27 expecting them to be going out and visiting and maintaining
28 and inspecting and so forth?

29 A Absolutely.

30 THE COMMISSIONER: I think this

1 would be a convenient time to adjourn, Mr. Scott.

2 We'll adjourn till 2:00.

3 (PROCEEDINGS ADJOURNED TO 2:00 P.M.)

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1
2 (PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)
3

4 THE COMMISSIONER: Come to
5 order, ladies and gentlemen. Commission counsel was
6 cross-examining this panel.
7

8 CROSS-EXAMINATION BY MR. GOUDGE, CONTINUED:
9

10 Q If I might sir, just a
11 couple of questions that were left over from this morning
12 to address to the panel.
13

14 Mr. Hushion, you say in your
15 canned evidence that Yellowknife will be your operations
16 headquarters. I understood that correctly, I think?
17

18 WITNESS HUSHION:
19

20 A Yes.
21

22 Q I wondered if you con-
23 sidered any other centres north of 60 before you came
24 to that decision?
25

26 A Well yes, I think we con-
27 sidered the other possibilities. I think as I said
28 this morning when we decided that we would have a dist-
29 rict headquarters at Inuvik, Norman Wells and Simpson,
30 then it fitted a little bit more.

Q I'm sorry, I didn't hear
that last.

A It fitted a little bit
more, that with other reasons that we would set the
operations headquarters in Yellowknife.

Littledale, Mirosh, Hushion
Cr. Exam. by Mr. Goudge

Q Did you consider Hay River
as a possibility?

A Yes, but I think the fact
that Yellowknife, as I said, had some other reasons. It
has, I think good transportation although I would admit
that Hay River would have that also. Perhaps being a
little bit larger centre, and more acceptable in the way
of social needs, if you will in Yellowknife, that --
led us to make that decision.

Q The fact that it's bigger
than Hay River weighs in on the side of Yellowknife, in
your --

A Partly, in a way to entice
employees that were required, this is the hard core type
that would be needed into Yellowknife.

Q What about considerations
like adding to the supply of housing stock? Did you
give any consideration to whether it would be easier to
add the 50 odd dwelling units you may contemplate at
Hay River, rather than Yellowknife?

A Well I think they may be
absorbed a little easier into Yellowknife than they
would be perhaps into Hay River.

Q I take it though you didn't
do any studies in that direction?

A Well not in studies in
the sense of total investigation, but I think just in
discussions and trying to reach maybe some quicker
decisions, we decided that Yellowknife was quite fitting.

Q Basically, though, I

1 understand you to say that it's size and social amenities
2 that give Yellowknife a preference over Hay River?

3 A I think those would be
4 certainly the most important reasons that we would do
5 it.

6 Q Are there any others that
7 are in that league of importance?

8 A Well it's accessible from
9 the south, mind you, because of --

10 Q But Hay River is as well,
11 so that --

12 A Yes it is, yes, there
13 might be a little bit better communications too, I
14 suppose from Yellowknife. Another thing too, it seems
15 that many of the companies have headquarters or their
16 offices there. It seems to be more -- well it's just
17 bigger, so it's more of a centre and perhaps for that
18 reason, maybe much easier to use it as the headquarters.

19 I suppose it's the same basis
20 as the -- perhaps the government felt where they located
21 themselves too.

22 Q And I take it it would
23 count in Yellowknife's favour, as far as your operat-
24 ions headquarters are concerned, that the government is
25 here?

26 A It's another added
27 feature, yes. It would be close proximity for your
28 daily discussions and communications with those people.

29 Q One other area, Mr.
30 Hushion. You spoke this morning, I think, about the

1 training program that you hope to create to entice
2 northerners, and particularly native northerners into
3 your permanent program. Did I understand that
4 correctly?

5 A Yes.

6 Q I wonder whether you are
7 at all familiar with other major industries that have
8 operated in the north, say in the construction or mining
9 sectors of the economy, and their training programs
10 aimed at the same end?

11 A Well I think we know some-
12 thing about it, probably not as much as we might need
13 to, but we do have as I say, our other group, our social
14 group that's really involved with trying to look at that
15 type of problem and find some ways of integrating it
16 with the pipeline.

17 Q Just by way of preview of
18 Phase 4, I wonder if you formed any opinion as to what
19 your training program would do differently in order to
20 perhaps surpass in success, the training programs that
21 have existed heretofore?

22 A Well that's quite a diffi-
23 cult area, isn't it? Mind you, I think at least we
24 could say that we could point to being successful in
25 the original training program that we had in our needs
26 as far as the pipeline, and the people that would be
27 required for it since we started that program back in
28 '72, and have had people going through it and it's quite
29 successful.

30 I think it's been one of the

1 programs that have been considered more successful,
2 mostly by way of the amount of turn-over -- I have for-
3 gotten what the numbers actually were, but it was small
4 in comparison to turn-over in other training programs
5 that I believe have been tried.

6 Q I take it, just to reiter-
7 ate your social and economic consultants are looking at
8 that and will be telling us more about it subsequently
9 in this Inquiry?

10 A It's one of their most
11 important issues, yes.

12 MR. GOUDGE: Thank you, sir.
13 Those are all the questions I have of this panel.

14 THE COMMISSIONER: Mr. Mirosh,
15 yesterday, when you were giving evidence on the last
16 panel, you mentioned a proposal or the possibility of
17 using tankers -- and tell me if I have got this right
18 or wrong -- tankers to bring fuel oil into the harbour
19 at Tuktoyaktuk during pipeline construction. Did I get
20 that right, or have I got that mixed up?

21 WITNESS MIROSH:

22 A No, that's correct. We
23 have been looking into the possibility of bringing a
24 tanker into the north end of the -- not into the
25 Mackenzie system, but around Tuktoyaktuk, with the sub-
26 sequent requirement for shuttling fuel of different
27 kinds from that tanker to spreads on the northern end
28 of the pipeline system.

29 THE COMMISSIONER: Well you
30 said that the tanker that you had in mind would be

Littledale, Mirosh, Hushion
Cross Exam by Mr. Goudge

35,000 tons. I think you said that?

A Yes, that was the number that we considered.

THE COMMISSIONER: And it would be carrying fuel oil for use by the machinery, trucks, heavy equipment and so on, that would be used in pipeline construction?

A Yes.

THE COMMISSIONER: How many trips each shipping season, would you expect the tanker to make? Just one?

A This would be just a single trip which would go towards relieving the burden on the south end, yes.

THE COMMISSIONER: Well, would it be one trip -- only one year, or would that trip be repeated during the two or three years of construction?

A Well the way we have looked at it so far is it would be one trip, which could occur during the first summer prior to any pipeline construction, and if that particular trip for whatever reason was not successful, it could be repeated the second year.

THE COMMISSIONER: You mean if you didn't get in the first year?

A If we didn't get in, then this might be a possibility for the next year, but the primary purpose was to take the peak off barge requirements, if we could, and of course if it was successful the first year, we would probably consider

doing it the second year as well

Q Do you know what the largest displacement is of any ocean going vessel that has been brought around Point Barrow as far as Tuktoyaktuk Harbour?

A No sir, I don't have that figure, but we have had people experienced in that kind of transportation advising us and they came up with the 35,000 ton figure.

Q Who was advising you?

A Will you just give me a minute to think of the name.

Yes, it was a Mr. Doug Dewar who is an executive of the Coastal Barge Operators Association, I believe in Vancouver.

Q How long is that shipping season around Point Barrow and across the Arctic -- across the Beaufort Sea to Tuktoyaktuk. two months, three months, do you know?

A Well I think we'd look at, probably having no more than six weeks and hoping to unload all of the fuel within a period of four weeks or 30 days.

Q Have you any idea what percentage of your total fuel oil requirement, the tankers, that trip, would represent?

A Yes, I believe that we require some 170,000 tons of diesel and gasoline so that 35,000 tons would represent about one quarter of that.

Q Well that goes back to the last panel, I'm sorry, Mr. Hollingworth, but I should

1 have thought of that yesterday, but -- and I don't
2 even remember the title of the last panel, but all
3 I know was Mr. Mirosh was on it. But if counsel have
4 any questions arising out of the questions I put, please
5 feel free.

6 All right.

7 MR. GOUDGE: I have no further
8 questions of this panel, sir.

9 THE COMMISSIONER: Yes.

10
11 THE COMMISSIONER: All right,
12 well thank you very much Mr. Hushion, Mr. Littledale,
13 Mr. Mirosh.

14 (WITNESSES ASIDE)

15 MR. GOUDGE: We thought I
16 think sir that subject to what you may say, Mr. Genest
17 has Mr. Dau available to put in some evidence that
18 really I think is essentially a clarification of his
19 evidence given some time ago, and that might be con-
20 veniently done now.

21 MR. GENEST: I have no
22 objection sir, Mr. Templeton was scheduled but I think
23 it suites my friend's convenience if Mr. Dau should go
24 first. Mr. Dau is actually being recalled, as part of
25 the cross-examination conducted by Mr. Scott, and was
26 in connection sir, with contractor's estimates, relating
27 to spreads and the productivity of spreads. We were
28 asked -- Mr Dau was asked to go back and look up his
29 records and come back with the estimates provided by the
30 contractors and how he arrived at his spreads. I have

Dau, Williams
In Chief

1 that now and for the convenience of my friends I thought
2 there was a panel, the question arose during our
3 construction panel' which consisted of Mr. Dau, Mr.
4 Williams and Mr. O'Rourke who was there to deal with
5 logistics, and if I could recall both Mr. Williams and
6 Mr. Dau were concerned with this matter. For the
7 convenience of my friends I have had the information
8 put together, actually Mr. Dau prepared a memorandum
9 to Mr. Marshall that put some tables and documents in
10 there setting and I have distributed these to my
11 friends and perhaps sir, I could hand one to you, and
12 have one filed as an exhibit.

13 The first part consists of
14 an explanatory section, which I think Mr. Scott suggested
15 this morning, if it's agreeable to Mr. Goudge,
16 perhaps Mr. Dau could simply read into the record and
17 it contains a number of schedules, tables and schedules
18 which Mr. Dau is prepared to deal with under cross-
19 examination by Mr. Goudge. May I call these persons
20 now?

21 THE COMMISSIONER: Yes.

22 MR. GENEST: Mr. Dau and Mr.
23 Williams, would you come forward.

24 They've both been sworn sir.

25 PHILLIP HARVEY DAU: Recalled

26 GUY LESLIE WILLIAMS: Recalled

27 THE COMMISSIONER: Mr. Goudge,
28 I don't want that evidence that Mr. Mirosh just gave
29 about the proposal to bring fuel oil into Tuktoyaktuk
30 by tanker to be overlooked, but what I've said will appear

1 on the record and Commission counsel staff will I know,
2 look into it.

3
4 MR. GENEST: Mr. Dau, you're really
5 under cross-examination by Mr. Goudge now, but perhaps
6 you could read your memorandum to Mr. Marshall into the
7 record and explain the material that is attached to it.

8 WITNESS DAU:

9 A This is the memorandum
10 to Mr. Marshall, dated September 22, in respect to
11 contractor input to CAGPL Planning and Scheduling.

12 In the May 15, 1975 trans
13 cript, pages 5155 through 5167 I was cross-
14 examined by Mr Scott with respect to construction
15 scheduling and planning, andⁱⁿ this series of questions and
16 answers, I attempted to explain the role of the con-
17 tractors that were retained by Northern to provide
18 information on these matters. In the transcript for
19 June 6; 1975, pages 6652 through 6662 in an exchange
20 between you and Mr. Scott, it is quite apparent that the
21 role of the contractors that were retained in the
22 construction scheduling and planning had been mis under-
23 stood. To clarify this matter, I think it necessary to
24 provide some background information.

25 A Round mid 1972 it was
26 decided that cost estimates by pipeline contractors would
27 be desirable for the project. Contractors selected to
28 provide this information were Banister Pipelines
29 Limited in Edmonton, Alberta, Henuset Brothers
30 Limited from Calgary, H.C. Price of Canada Limited from

1 Calgary, Mannix Company Limited from Calgary, Marine
2 Pipeline Limited from Calgary, Joyce Leonard Canada
3 Limited from Calgary and Associated Contractors Limited
4 from Calgary and Michael Curran and Associates from
5 Denver, Colorado.

6 The selection of these
7 contractors and the general scope of their assignments
8 was determined prior to the merger of the Northwest
9 Project and Gas Arctic into Canadian Arctic Gas. The
10 route selected for investigation was the Northwest
11 Project direct route from Prudhoe Bay and the Mackenzie
12 Delta to Emerson Manitoba, with a delivery lateral
13 from the Cold Lake area to Kingsgate.

Dau, Williams
In Chief

Two reconnaissance trips were arranged in August and September of 1972 when the contractors were flown over portions of the route, and assigned sections of line to investigate in as much detail as time permitted. An additional trip was arranged in mid-December, 1972 to visit the Mackenzie Delta area to assess the climatic conditions which would be encountered during a winter construction season. On this trip, operating personnel from drilling rigs were contracted with respect to winter working conditions and construction on portions of the Dempster Highway was observed.

Beginning December 5th and continuing through December 8th, 1972, preliminary discussions were held with those contractors to outline the scope of work they were requested to perform and obtain their comments. During these discussions they were provided copies of two alternative construction plans, identified as Schedule 1 and Schedule 3. On January 11, 1973, each of the contractors were advised by letter of the scope of work that was requested, and were also provided with a revised construction Schedule number 7. A copy of the January 11th, '73 letter and the three schedules referred to are attached.

We have not been able to locate the original drawings of these schedules, and have had them redrawn from working copies. Construction schedule number 7 identifies the route segments the contractors were to estimate. The estimates were received and further discussions held in February to May of 1973 with

Dau, Williams
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1 each of the contractors.

2 Table 1 attached lists progress
3 rates, work times and manpower estimates received from
4 the contractors for the main line segments north of Cold
5 Lake.

6 Table 2 lists similar inform-
7 ation for the current estimates, for the prime main line
8 route north of the Athabasca River. The estimated
9 daily production rates from the contractors varied widely.
10 After considering these estimates, we applied our own
11 judgment based on our knowledge of northern conditions
12 and concluded that the following rates were reasonable
13 and practical.

14 In prairie construction, 100
15 pipe joints per day; Cold Lake to the 60th parallel,
16 80 pipe joints per day; 60th parallel to Fort Good
17 Hope, 75 pipe joints per day; and from Fort Good Hope
18 to Richards Island, 60 pipe joints per day.

19 In addition three of the
20 contractors expressed a preference for Schedule number
21 1 and three for Schedule Number 2. Two contractors
22 voiced no preference.

23 The contractors comments on
24 spread lengths varied considerably from 50 miles to 80
25 miles for a winter construction season. One contractor
26 recommends 65 to 77 miles, one 70 to 75 miles, one 50
27 to 64 miles, one 70 miles and one stated that the
28 lengths shown on schedule number 7 should be considered
29 a maximum.

30 THE COMMISSIONER: What does

Dau, Williams
In Chief

1 that mean, Mr. Dau? That the length shown in schedule
2 number 7 should be considered a maximum.

3 A Schedule 7, sir, which is
4 attached to the letter identifies the areas that the
5 contractors were requested to provide estimates for, and
6 the lengths of those sections are shown on that schedule
7 and they vary, I believe from 80 miles -- 82 miles, I
8 think down to 60 some.

9 THE COMMISSIONER: And that
10 contractor said those figures you have there should be
11 considered maximum figures so far as mileage per winter
12 per spread is concerned?

13 A Yes.

14 THE COMMISSIONER: Sorry.

15 A And Mr. Williams has just
16 noted that on the -- on page 3, at the bottom of page 3
17 there's another typo. It should be schedule number 1
18 and 3, a preference for schedule number 3, not number 2.

19 Table 1 that's attached to the
20 memorandum, lists the length of the section that the
21 contractor looked at. The contractors' estimate and
22 progress and on work day basis and on a calendar day
23 basis, contractors' estimate of the time that was avail-
24 able in work days and calendar days and their estimates
25 of the total manpower in each spread.

26 MR. GENEST:

27 Q How do we tell the cont-
28 ractors on the right hand side? For instance, what
29 does M4 stand for?

30 A Again, Mr. Genest, you will

Dau, Williams
In Chief

1 have to refer to Schedule 7 where the contractors are
2 listed and the code is listed also.

3 Q I see.

4 A M4 stands for Mannix, the
5 4 refers to section 4 that we asked them to look at.

6 Q I see.

7 A The average for those
8 contractors estimates north of the Mackenzie River was
9 67.2 miles. The average of all their estimates
10 for work progress was 4,962, and the work day basis, on
11 a calendar day basis, 3,722. The average of their
12 estimates for the work days that were available is 77.7,
13 average for the calendar days was 99.8, and their
14 average of the manpower totals was 721, with similar
15 information for the Mackenzie River to Cold Lake.

16 Table 2 contains similar
17 information that's currently in our cost estimate and
18 planning. Again, these are not exactly comparable
19 because the routes are different. The contractors'
20 estimates were on the so-called gun barrel route and
21 this is on our prime route.

22 Q Well Table 2 represents
23 your own judgment?

24 A That's correct, sir.

25 Behind those tables is the
26 letter that was sent to the contractors, letters dated
27 the 11th of January, and then finally the three schedules
28 that are referred to, number 1, number 3 and number 7.

29 MR. GENEST: Sir, having had
30 my crack at these witnesses in examination-in-chief,

Dau, Williams
In Chief

1 and this being in response to cross-examination, I think
2 I should pass the ball back to Mr. Goudge now.

3 THE COMMISSIONER: Should this
4 document be marked as an exhibit?

5 MR. GENEST: I think it would
6 be convenient, sir, if that's satisfactory.

7 MR. GOUDGE: Yes sir, I think
8 that's appropriate.

9
10 (MEMORANDUM TO MR. MARSHALL RE CONTRACTOR INPUT
11 TO CAGSL PLANNING AND SCHEDULING, MARKED EXHIBIT
12 155)

13 THE COMMISSIONER: You're
14 cross-examining, I guess.

15 MR. GOUDGE: Well I'm content
16 to cross-examine, sir. It may be that since this really
17 is evidence in chief, deja vu, my friends may want to go
18 in the usual order.

19 THE COMMISSIONER: All right,
20 do you want to ask any questions, Mr. Hollingworth?

21 MR. HOLLINGWORTH: I received
22 this information at approximately 9:00 o'clock this
23 morning, sir. I had a chance to read it over briefly
24 at lunch time, and I am just in no position at all to
25 ask any questions at this time.

26 MR. GENEST: I may say, sir,
27 I don't treat it as examination in chief. It's a
28 response to a question that I certainly --

29 THE COMMISSIONER: It doesn't
30 fall within the rules.

1 MR. GENEST: Right, right.

2 THE COMMISSIONER: It's further
3 information sought on cross-examination?

4 MR. GENEST: Right.

5 THE COMMISSIONER: We are happy
6 to have it. Well, Mr. Goudge, you go ahead and --

7
8 CROSS-EXAMINATION BY MR. GOUDGE:

9
10 Q Feeling my way, Mr. Dau,
11 like the rest of us I think, could you turn please to
12 Table 1? I think I understood what you said to Mr.
13 Genest, insofar as identifying the contractors are con-
14 cerned. I can learn their identity by turning to
15 Schedule 7 --

16 A Right.

17 Q -- and reading off that
18 schedule, or find the letter matching the contractor
19 and the spread matching the number beside the contractor's
20 letter?

21 A Yes.

22 Q The next column, miles,
23 designates I take it, the length of the sections they
24 were asked to examine?

25 A. Yes sir.
26
27
28
29
30

1 Q The next column is headed
2 progress in feet per working day. Is that correct?

3 A That is correct sir.

4 Q And is is the figure
5 in that column obtained in each case?

6 A That's extracted from
7 the information that the contractors provided us.

8 Q They simply gave you that
9 figure?

10 A Yes.

11 Q I see.

12 A It's their judgment of
13 the amount of work they could do in a work day.

14 Q Now if I could jump to
15 the column on the right hand side, manpower total. I take
16 it indicates the spread size that each contractor
17 contemplated using when he was preparing his estimate?

18 A That's correct sir.

19 Q So the relation between
20 the third column and the manpower column, presumably
21 insofar as the larger manpower total results in a larger
22 progress, per working day,

23 A That would be part of
24 it. It's not directly related to it.

25 Q Was the contractor in
26 each case free to choose whatever manpower total he
27 wished?

28 A Yes.

29 THE COMMISSIONER: Excuse me,
30 I wonder -- there's one, I just noticed, with 750 workdays.

1 is that --

2 A I suspect that should
3 be 75 sir.

4 Q We should strike out that
5 zero. I'm sorry, Mr. Goudge, I just --

6 MR. GOUDGE:

7 Q So the contractor began
8 in each case with complete freedom to choose the spread
9 size in terms of manpower?

10 A Manpower and equipment
11 and so on, yes sir.

12 Q Now moving to column
13 four, that again is a figure supplied to you simply
14 by the contractor based on his own estimate?

15 A That's correct sir.

16 Q Yes. I see I think
17 I understand that. Now moving to table -- I think I
18 understand the other two columns, moving to table 2,
19 that is your present estimate of your spread capabilities
20 as per your application?

21 A Yes sir.

22 Q And I do a quick comparison
23 of the averages at least for tables one and two, and
24 taking a comparison of the second columns in each case,
25 I see that your present estimate for your own spreads,
26 contemplates 70.7 miles per spread per season, whereas
27 the contractors supplying you with information in table
28 one came up with 67.2 as their average, is that the way
29 those are compared?

30 A No, the contractors did not

1 select the length of the sections, that's ours,
2 we gave them that.

3 Q Comparing the
4 averages for the third columns on the two tables, your
5 conclusion is that your progress in feet per working day
6 is substantially less than the average of the figures
7 supplied you by the contractors? The comparative being
8 3997 to 4962, is that --

9 A That's correct sir.

10 Q -- a valid comparison.
11 The next comparison that occurs as I read it, is that
12 of working days, there seems to be a less conservative
13 approach by you than by the contractors, as I compare
14 those tables insofar as you allow for 93.2 working days
15 per season, the contractors estimate it 77.7, is that a
16 valid reading of the two tables?

17 A That is correct sir, we
18 believe that the -- those two columns, on the calendar
19 day and work day, we have more time than the contractors
20 came up with. We say there is 136 calendar days available.
21 and their average is essentially 100, varying from I
22 guess 74 to 150 was the range, and that also carries
23 over to the working day where they've got essentially 78
24 and we say 93 on an average day basis.

25 Q In fact, your average is
26 higher than the highest estimate from any individual
27 contractor as I read the tables?

28 A That's correct sir.

29 Q Do you have any explanation
30 for the difference in view that you appear to have between

1 yourselves and the contractors?

2 A Yes, I think we've got
3 a lot more knowledge and information about this
4 project today than we had at the time the contractors
5 looked at it for one thing. I think we view the pro-
6 ject in perhaps a different way than these contractors
7 viewed the project at that time and that's kind of
8 difficult to explain. It's my view that this is
9 obviously a very large project, and that we are going
10 to have to do construction at times, that the contractors
11 traditionally have not done construction. The contractors
12 as I understand it, on winter work, would like to leave
13 their main operations for instance until after the
14 new year, in some operations they would proceed earlier
15 in the year, obviously the clearing and grading and
16 things like that. Northern Alberta work. It's more
17 convenient for them that way. But this is such a large
18 project that some of those conveniences we just can't
19 live with them. We're going to have to start work as
20 early as we can, we're going to have to, as we explained
21 many times, manufacture snow for roads if necessary
22 and start as soon as we can, that's the basic difference
23 I think we have between ourselves and the information
24 the contractors provided us.

25 Q These contractors I take
26 it are the leaders in pipeline construction in the coun-
27 try is that so?

28 A Just about all of them, yes.

29 Q And for you to build the
30 line, you'd be required to use the services of most of

1 not all of them?

2 A Yes.

3 THE COMMISSIONER: They're
4 not the leaders, they are the contractors, is that what
5 you're saying?

6 A I believe there's one
7 major one that's not on the list.

8 Q Who is that?

9 A Majestic I believe is the
10 only other major one. I think that's the only major
11 one that's not there sir.

12 MR. GOUDGE:

13 Q Have you reviewed with
14 the contractors since the preparation of table 2, the
15 figures for working days and calendar days to see if
16 they feel those dates are within the bounds of
17 possibility?

18 A No, I have not.

19

20

21

22

23

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Dau, Williams
Cr. Exam. by Mr. Goudge

1 Q I take it the last discuss-
2 ions that you had with the contractors who will be
3 building this project resulted in Table 1, if I can put
4 it that way?

5 A Well I don't quite under-
6 stand, Mr. Goudge.

7 Q Well, when you prepared
8 Table 1, you obviously had lengthy discussions with the
9 contractors, and from that were able to determine their
10 best estimates of the calendar days and working days
11 they felt would be available each year. Have you since
12 the preparation of Table 1 and since those discussions,
13 had further discussions with them, which indicate a
14 change of view on the part of the contractors?

15 A No we have not, but --

16 Q So your best information
17 at the moment is --

18 MR. GENEST: He had a but
19 there, Mr. Goudge. Would you allow him to complete his
20 answer, please?

21 MR. GOUDGE: I'm sorry, Mr.
22 Dau.

23 A I just wanted to make
24 sure. The information that's on Table 1 comes from
25 the detailed estimates that the contractors provided.
26 It's not as a result of discussion with contractors,
27 it's out of their detailed cost estimates that we did
28 have discussions with the contractors after we
29 received their detailed estimates. There were some
30 meetings, clarification and so on. We have not gone

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1 back to the contractors to discuss our estimate with
2 them.

3 Q Is it fair, though to say
4 that your best information at the moment is that the
5 contractors in the industry hold an average work day
6 season to be roughly 77.7 days in the north?

7 A At that moment in time,
8 that's correct, sir, that was their judgment.

9 Q And you've no reason to
10 believe that their judgment has altered, or do you?

11 A I suspect that it would,
12 sir, if we brought them -- had we provided them with all
13 the information that's currently available, the planning,
14 and a complete description of what has to be done and
15 how it's to be done. Yes, I do believe that they
16 would increase those time periods.

17 Q Now I noticed that --
18 well before I leave that, are discussions of that kind
19 contemplated by you?

20 A Not in the immediate
21 future, sir, no.

22 Q I notice in the referring
23 letter that Mr. Williams wrote to them, at least in the
24 second paragraph on page 2 of the letter, the request
25 was made on the basis that the opinions solicited
26 should be based on construction economics, rather than
27 environmental considerations. I take it then that the
28 estimates given you by the contractors contained no
29 elasticity or protection of the environment consider-
30 ations?

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WITNESS WILLIAMS:

A I think that that particular sentence, Mr. Goudge, refers to the river crossing construction, the first seven river crossing constructions.

Q Well that's what I wondered about, Mr. Williams. Was there any then similar direction given regarding the estimates as a whole?

A Well back on the first page, listed in the information that we gave to them, is a copy of draft specifications, item 3, and those draft specifications included our assessment of environmental considerations at that time. At least the specifications as to what the contractor should be aware of, similar to things that you would find in the northern guidelines, for instance, or the Land Use Regulations. This sort of information, as a guide to them in making their cost estimates.

Q I take it that part of the draft specifications at least was included to provide them with an environmental component in their thinking, is that --

A That would be part of it, yes.

Q Just out of curiosity, why was there not an environmental component put into their river crossing estimate?

A Really what we were looking for there was their judgment as to what time of the year, what season of the year they thought those major

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1 river crossings should be constructed.

2 We were wondering ourselves at
3 that time, and we wanted their best judgment, as to when
4 it could best be economically done, and we would then
5 assess their reasons for choosing those seasons against
6 what we knew would be the environmental problems.

7 To ask the contractors to
8 assess the environmental problems at that time, I think
9 would have been very difficult.

10 Q Based on the draft speci-
11 fications that you did provide them concerning environ-
12 mental matters, do you have an opinion as to whether
13 their estimates would be different, given the environ-
14 mental considerations you now take into account in your
15 own planning?

16 A I don't think so. In
17 the preliminary meetings before they provided the cost
18 estimates, we devoted a lot of time to grading, for
19 instance. This was -- the contractors considered this
20 a vital aspect, and we were telling them that in the
21 sensitive permafrost areas that they just wouldn't be
22 able to work in a conventional manner, that grading
23 would be cut down to the very minimum. This gave them
24 trouble, because we said that they would have to get by
25 with levelling the right-of-way with snow.

26 We certainly at the same time
27 spent a fair bit of time discussing snow roads, and
28 protection of the vegetative cover, which I think are
29 the main items that would affect a contractor's
30 planning.

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1 Q Finally, Mr. Dau, by way
2 of comparing the tables, the comparison that strikes me
3 as one in which the contractors were more optimistic
4 than you, is that of progress per working day. The
5 difference there is substantial.

6 WITNESS DAU:

7 A Yes.

8 Q What's your explanation
9 for that difference? Why do you feel that an average
10 spread could accomplish some thousand feet a day less
11 than the contractors feel?

12 A Well making this assess-
13 ment was not easy. It's difficult to do, and I think
14 it's just a case that we thought they were too optimist-
15 ic, that it would not be appropriate to use that high a
16 number, considering the time frame that we selected.

17 We expanded the time, calendar
18 and work days, although what the contractors thought
19 would be available, and at the same time we reduced the
20 amount of work that could be done on the average day
21 over that time frame.

22 I don't know if I am responding
23 very well, but it's -- you can't isolate one thing all
24 by itself. You've got to look at it in the overall
25 picture.

26 Q Did it have anything to do
27 with the fact that they perhaps intended on blasting
28 more than you intend to?

29 A No, I'm sure that isn't
30 the case, sir, no.

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1 Q That didn't enter into it?
2 A No sir, that wouldn't be
3 part of it.

4 We provided them with all of
5 the information that we had at that particular moment in
6 time with respect to terrain type being our estimate on
7 rock that would be encountered and things like that.

8 Q Now in terms of northern
9 experience, do all these pipeline construction companies
10 do any of them have northern experience, as far as you
11 know?

12 A Northern Alberta experience
13 for instance. Yes, they do. I think all except Curran
14 and Associates have done winter work.

15 Q Curran is the only one
16 that's not?

17 A I believe that's correct.

18 MR. GOUDGE: Thank you, sir.
19 Those are all the questions I have arising out of this
20 material.

21 MR. HOLLINGWORTH: Mr.
22 Commissioner, did I understand that Mr. Genest's object-
23 ion -- that there was an objection on the part of Mr.
24 Genest to cross-examination by any people other than
25 Mr. Goudge?

26 MR. GENEST: No, no, no, no.

27 THE COMMISSIONER: You go
28 ahead.

29 MR. HOLLINGWORTH: Thank you.

30 MR. GENEST: Having regard to

Dau, Williams
Cr. Exam. by Mr. Hollingworth

1 what was allowed to me yesterday, I think I wouldn't be
2 heard very long.

3 MR. HOLLINGWORTH: I was pre-
4 pared to argue that.

5
6 CROSS-EXAMINATION BY MR. HOLLINGWORTH:

7
8 Q Mr. Dau, I assume that when
9 these contractors were notified and asked for their
10 figures, that certain details of the job were given to
11 them, such as the fact that they were going to be dealing
12 with 48 inch pipe of a certain wall thickness, and of a
13 certain tonnage. Would that be accurate?

14 A Yes, sir.

15 Q And I assume that in fact
16 they would need quite a few specifications as to the
17 actual pipe involved, and the amount of equipment in-
18 volved before they could really make up these figures.
19 Wouldn't that be a fair statement?

20 A Well they were given a
21 preliminary set of construction specifications to assist
22 them in their estimates, and they were certainly given
23 all of the information we had, the physical information
24 about the system which was a 48 inch pipeline system
25 with .72 wall pipe.

26 We gave them -- I'm not sure
27 whether we gave them the terrain types alignments --
28 yes, we gave them the terrain typed alignment sheets,
29 for instance, and so on, and things like that. Is
30 that what you are referring to?

1 Q Yes, well this goes back
2 -- you have raised one point. This goes back to the
3 Northwest Study Group days sometime ago, but even at
4 that time it was contemplated using 48 inch pipe of a
5 .720 wall thickness, was it?

6 A Yes.

7 Q That's the specification
8 you gave?

9 A I'm sure that's correct.
10 If it isn't --

11 Q What about crack
12 arrestors?

13 A No, sir, there was no
14 crack arrestors.

15 Q That wasn't considered
16 in those days?

17 A No, sir.

18 Q So that obviously when
19 they were given specifications for coating of the pipe,
20 they didn't have to take that into consideration at all?

21 A No sir.

22 Q Now, did you go into the
23 question of provision of snow roads for this equipment
24 to go over during the season that you contemplated?

25 WITNESS WILLIAMS:

26 A The construction plans
27 certainly included snow road construction, yes, sir.

28 Q And the contractors were
29 aware of this and the dates when you felt it could start
30 and when it could finish?

1 A In the discussion, yes,
2 that aspect was discussed, certainly.

3 Q Were the contractors asked
4 to comment as to whether snow roads could effectively
5 be made as early as you're suggesting and go as late
6 as you're suggesting?

7 WITNESS WILLIAMS:

8 A I don't specifically
9 recall that sir.

10 Q Or was it a question you
11 gave the figures to them and said make this
12 assumption.

13 A I think we told them
14 that was the manner in which it would -- would have
15 to be constructed, through the extensive use of snow
16 roads.

17 Q Well were the contractors
18 also asked to assume that the snow roads would be in
19 good shape for the period that you're suggesting they
20 would be in use?

21 A Oh, I've forgotten, it
22 was quite a while ago. I know on the trip that we took
23 to the Delta, in about December the 15th, we examined
24 fairly closely a road that was -- a snow road that had
25 been used to move a drill rig. we talked to the people
26 that moved the rig, the problems that they had encountered,
27 and the difficulties, but it was -- at that stage, things
28 were a little fuzzy because we hadn't done the research
29 in snow road construction that we have since done. We
30 weren't able to supply them with that kind of information
Mr. Hollingworth.

Q Well your answer suggests
to me that the contractors were asked to form their own

1 judgment then as to whether these snow roads could be
2 used for that period of time, would that be an accurate
3 statement?

4 A We certainly invited comments
5 from them in any area that they thought may be a problem
6 and at the same time we gave them our best information
7 at the time.

8 Q And did you receive
9 comments from them about how long snow roads might last?

10 A No, I don't recall any
11 specific comments.

12 Q In any event, they weren't
13 to address themselves to environmental considerations?

14 A The letter states to
15 forget about the environmental considerations with
16 respect to certain river crossings. I think it also
17 says elsewhere in the letter that we would be glad to
18 hear any suggestions that they may have with respect to
19 the total project.

20
21 Q Did they specifically
22 give you any comments as to whether they had confidence
23 in the stability of the snow roads built over the period
24 of time that you were contemplating?

25 MR. GENEST. We haven't had
26 it established yet, Mr. Hollingworth, that Mr. Williams
27 ever told them that they were contemplating any
28 specific period of time for the snow roads. So, that
29 question ought to be broken up, it seems to me.

30 MR. HOLLINGWORTH: I thought we

1 had established that they were going to be using snow
2 roads over a period of time given to them.

3 MR. GENEST: Well let's check
4 that with Mr. Williams.

5 A I think I said that they
6 were advised that they would have to make extensive
7 use of snow roads over the construction of the sections
8 that they were looking at.

9 MR. HOLLINGWORTH:

10 Q Well dealing with
11 sections say north of Fort Good Hope, were they told
12 they would use snow roads extensively or exclusively?

13 A Extensively. It was
14 mentioned earlier that we told them that in our opinion
15 that cut grading would be reduced to the very minimum.
16 That we couldn't see that as an economic or proper way
17 of constructing this pipeline.

18 Q On those portions where
19 you would use snowroads, did the contractors express any
20 confidence as to whether the snow roads would be stable
21 over the period of time of construction that you were
22 contemplating?

23 A Some of them certainly had
24 some reservations sir, about that type of construction.
25 Because they just haven't had any experience with it
26 sir. I think as Mr. Dau stated, if we gave them all
27 the information that we have now, that probably quite a
28 few of those reservations would disappear.

29 Q Do you recall which ones
30 expressed reservations?

1 A Oh, Curran in particular
2 comes to mind. H.C. Price also comes to mind, those two
3 I think were two that had some reservations.

4 Q Were they the only ones
5 or the only ones you can recall?

6 A They're the only ones I
7 can recall.

8 Q Now, how did the
9 contractors -- the contractors first of all I assume
10 were aware that they would be working in darkness in
11 winter construction season in the Arctic?

12 A Yes sir.

13 Q And did they express any
14 opinions to you about that?

15 A I don't recall any of them
16 expressing any -- giving us any grave reservations about
17 artificial lighting of the spread. That was discussed.

18 Q Did they express any
19 opinion about a loss of efficiency from working under
20 artificial light as opposed to natural light?

21 A Sure, that along with
22 the weather, the harsh environment, they know as well
23 as we do that it's not going to be an easy job.

24 Q And so those allowances
25 account for the difference between calendar days and
26 work days on your tables, would that be correct?

27 A On our table?

28 Q Yes. Let's look at the
29 contractor table, since we're talking about the contrac-
30 tors, table one.

1 Now am I correct in assuming
2 that the difference between the 77.7 average for work
3 days and the 99.8 average for calendar days is reflected
4 in downtime?

WITNESS DAU:

5 A Yes, that's right, it would
6 have to be, yes.

7 Q And that downtime would
8 be accounted for from among other things the inefficiency
9 of working in the dark.

10 A No sir.

11 Q I'm sorry, I thought that
12 was your answer, that that in part, accounted for the
13 lack of efficiency.

14 WITNESS WILLIAMS:

15 A Yes, the lack of
16 efficiency is not reflected in those numbers, those are
17 down days. Weather days.

18 Q Straight down days when
19 nothing is going on.

20 A Yes sir.

21 Q Now, I'm not sure I got
22 your evidence, Mr. Dau, straight when Mr. Goudge was
23 cross-examining you, but the mile figure on table one,
24 I believe I heard you to say that that was provided to
25 the contractors?

26 WITNESS DAU: A That's correct.

27 Q So that there is no
28 correlation between that column of figures and the
29 figures expressed on page four of your memorandum to
30 Mr Marshall?

1 A No.

2 Q Well, when you say on
3 the first line on page four, the contractors' comments
4 on spread length varied considerably from 50 miles to
5 80 miles for a winter construction season, were these
6 recommendations that the contractors made to you as to
7 how far they felt they could go in the winter con-
8 struction season in one spread?

9 A Recommendations in the
10 sense it was carried out in a discussion and was their
11 view that these were -- that the amounts that should
12 be used for a winter spread. Now you've got to
13 remember, it depends on where you are on the pipeline and
14 so on. That has an influence on it too.

15 Q Well, in the next
16 sentence, you say one contractor recommends 65 to 77
17 miles, so is that fair then that that 50 miles to 80
18 miles also forms a recommendation.

19 A In that sense, yes.

20 Q And do you know what the
21 average length was recommended by the contractors?

22 A No, I don't.

23 Q Could you give me that
24 figure at some time?

25 A Yes, I think we can get
26 it, I think I can average them. I just don't have the
27 numbers here, I'll try and get it for you.

28 Q You can provide that to
29 Mr. Marshall and Mr. Genest. Thank you.

30 Now on these estimates made by

1 the contractors, did they take into consideration a break
2 for the Christmas season or did they assume that you would
3 be going right through the Christmas season?

4 WITNESS WILLIAMS:

5 A Oh, you can see from the
6 calendar days available, that they varied all over the
7 lot, Mr. Hollingworth.

8 Q I'm sorry. Mr. Williams,
9 will you direct me to that?

10 A Yes, it's on table one,
11 column six, where the available calendar days that
12 they suggest, varies from 74 to 150. The 150, I don't
13 think that would contemplate time off for Christmas.
14 Maybe quite a few of the others thought that it was
15 appropriate to start after the new year, that's reflected
16 in those numbers. I don't think there's a firm answer
17 to your question. Some did, some didn't and I think it
18 all ties in with the discussion that went on yesterday
19 and the day before, with your panel, that this is a
20 philosophy that the contractors have used in Northern
21 Alberta, of not starting their main construction until
22 after New Years. It's a philosophy that we think
23 can't be applied to this project.
24
25
26
27
28
29
30

Dau, Williams
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1 Q At the time you got these
2 contractor estimates, had any of them any experience
3 with 48 inch pipe and three quarter inch wall?

4 WITNESS DAU:

5 A I don't think so.

6 Q None at all?

7 A I expect not.

8 WITNESS WILLIAMS:

9 A Not of any magnitude
10 anyway.

11 MR. HOLLINGWORTH: Thank you,
12 those are my questions.

13 THE COMMISSIONER: Well Mr.
14 Williams, what did you say about the contractors who
15 work in northern Alberta? What is the length of the
16 winter season there? Did you --

17 A Well traditionally, sir,
18 they do some preparation work before the Christmas
19 season, in late November and the first half of December,
20 clearing and grading and inducing frost into the musked
21 terrain, or hauling pipe and setting up camps, this
22 sort of preparation work and then they bring on the
23 main pipeline crews immediately following the New Year.
24 That is traditional.

25 THE COMMISSIONER: How long
26 does the season last?

27 A The latter part of March
28 through to early April, I think Mr. Kosten said yester-
29 day that on the Peace River Oil Pipeline, that went
30 to Zama, that they worked until the middle of April.

Dau, Williams
Cr. Exam. by Mr. Bell

1 THE COMMISSIONER: Thank you.

2 Mr. Bell?

3
4 CROSS-EXAMINATION BY MR. BELL:

5
6 Q Yes, turning to Table 2,
7 your estimates of progress per day, I would just like to
8 know what exactly progress means. Does that mean pipe
9 in the ground?

10 WITNESS DAU:

11 A Yes, the progress --
12 well, this progress relates to welding progress.

13 Q Welding progress, and the
14 list of spread numbers down the left-hand side of the
15 page, do they refer to any of the attached schedules?

16 WITNESS WILLIAMS:

17 A No, they're in Volume 13A
18 of the application. I can get you that reference if you
19 want, Mr. Bell.

20 Q I would appreciate that.
21 While you are looking that up, I gather then that they
22 don't refer specifically to any of the attached sched-
23 ules?

24 WITNESS DAU:

25 A No, they do not.

26 WITNESS WILLIAMS:

27 A I don't know what the
28 exhibit number is. It's the construction plan, section
29 13A, and it's under a pink tab called pipeline construct-
30 ion assignments, and the drawing number is 3-0215-1001,

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1 revision 1.

2 Q Turning to the narrative,
3 at page 3, you list the rates at which you thought, I
4 assume it's welding, the rates at which you thought
5 welding could be done in four categories, and I would
6 like to examine the last two categories, the one 60th
7 parallel to Fort Good Hope, and Fort Good Hope to Richards
8 Island. You say 60th parallel to Fort Good Hope, 75
9 pipe joints per day. Is that based on 80 foot joints?

10 WITNESS DAU:

11 A It's any length. It's
12 the number of welds really is the best way to describe
13 it.

14 Q But you are going to be
15 using 80 foot joints though, aren't you?

16 A Yes.

17 Q Eighty foot sections?

18 A There will be some shorter
19 than 80 obviously, but generally yes, 80 foot joints.

20 Q Well is it fair then to
21 multiply that 75 by 80 to get the number of feet per
22 day?

23 A Yes.

24 Q Well I get 6,000 feet per
25 day --

26 A Yes.

27 Q -- in that 60th parallel
28 to Fort Good Hope, and the next one I get 4,800 feet
29 per day, that's Fort Good Hope to Richards Island, at
30 60 joints per day.

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1 A Yes.

2 Q And I've averaged them
3 and it comes out to 5,400 feet per day?

4 A Yes.

5 Q Well I would like you to
6 relate that back to Table number 2, where in the first
7 half or the first portion of the table, your estimate
8 of progress per day, north of the Mackenzie River is
9 slightly under 4,000 feet per day. Can you explain what
10 that apparent discrepancy means?

11 WITNESS WILLIAMS:

12 A I want to look up
13 spread designations

14
15 Q By all means.

16 WITNESS DAU:

17 A Fort Good Hope to Richards
18 Island, 60 joints per day, relates to, if you turn to
19 Table 2 --

20 Q Yes.

21 A -- relates to spreads
22 A1, A2, B1, B2, in which our average there is 4,247 on
23 a work day basis. 4,247 then corresponds to the 60
24 joints which if all joints were 80 feet, would be 4,800.

25 Now --

26 Q But they are not all 80
27 feet? There are some less than that?

28 A Yes, I can't respond by
29 saying you know, that their average is 73.2, or some-
thing. These are judgment numbers.

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1 Q Right. And the 60th
2 parallel to Fort Good Hope, what spreads does that
3 cover?

4 A That would be C and D,
5 and in that instance, it's 4,483 against the 6,000.

6 Q But that would mean there
7 would be -- does that mean that there are a larger
8 number of joints which are less than 80 feet, than
9 there would be in the Fort Good Hope to Richards Island
10 section?

11 A No, that's not the case,
12 sir.

13 Q Because the discrepancy
14 there seems to be a little larger.

15 A Yes, it is. These are
16 judgment numbers that we concluded that these rates
17 were reasonable, and then when we got into the detailed
18 estimates, why obviously you look at that particular
19 section and work it out in detail with the number of
20 miles, all the logistics problems, the construction
21 problems and so on, and each one of those spreads were
22 assessed in detail.

23 Q This discussion then
24 wouldn't lead you to revise your judgment downward, as
25 far as the joints per day is concerned?

26 A No, we think these are
27 achieved -- that is attainable.

28 MR. BELL: Thank you, that's
29 all I have.
30

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1 CROSS-EXAMINATION BY MR. BAYLY:

2
3 Q Mr. Williams, the questions
4 I want to ask you are based on the difference in your
5 application and that of Foothills, on the subject of
6 working before the end of January.

7 Now, I take it from the evidence
8 you have given today and evidence you had given earlier,
9 that you contemplate working from some time in the fall,
10 when the winter roads are usable, through Christmas and
11 depending on your contractor, breaking for Christmass or
12 not, and through January. Is that fair to say?

13 WITNESS WILLIAMS:

14 A I think what we have said,
15 Mr. Bayly is that in our opinion that we would start
16 work just as soon as it was physically possible. That
17 the camps would be set up and the equipment read to go,
18 and as soon as the weather conditions permitted, we
19 would see getting out and starting to build snow roads
20 and starting to lay pipe as soon as practical, after
the right-of-way had been prepared.

21 Now, you had a further question
22 about Christmas?

23 Q Yes, I'm less concerned
24 about that, but I understand some of your contractors,
25 the ones who have given you estimates of being able to
26 work 150 calendar days, or work through a period of 150
27 calendar days, might be prepared to work their crews
28 through the Christmas period?

29 A That would be the infer-
30 ence from that table. We did have substantial discussion

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1 with each of the contractors about this question, and
2 I don't think they all agreed on a number. I think
3 generally they agreed that some time should be allowed
4 during the Christmas season, that might have varied
5 from a few days to two weeks.

6 Q But this is a policy
7 matter, not one based on weather or darkness, I take it,
8 as far as you are concerned?

9 A It's a policy matter with
10 respect to the workmen, yes.

11 Q That's right.

12 A Yes, sir.

13 Q And I'll refer you to a
14 statement regarding weather and temperature made in
15 Volume 66 of the transcript, at page 9784, by Mr. Kosten,
16 in answer to the question "At what temperature would
17 you contemplate having to shut down", his answer was
18 "About 35 degrees minus Fahrenheit. This depends on
19 whether there is a wind along with the temperature".
20 Is that a situation you would contemplate running into,
21 having to shut down at that temperature?

22 A I think that's a reason-
23 able number, yes sir. But it depends on how well you
24 prepare the equipment and for shelters. The -- shelter-
25 ing the operations that you can, and the shelters that
26 you pull along the right-of-way to give men some time
27 in out of the weather, a few minutes every hour, say,
28 to have enough people to switch off to that extent.

29 It's pretty hard to set a
30 firm temperature. It partly depends on how well you

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1 are prepared.

2 Q Now in fixing that as an
3 approximate temperature, and I think to be fair to Mr.
4 Kosten, he was looking at an approximate temperature
5 and whether there was wind, et cetera, so he's in the
6 same position you are, he thought that somewhere between
7 20 and 25 percent of the days during the construction
8 period Foothills contemplated would be days when they
9 couldn't work because of these weather conditions.
10 Would you agree with that figure or would your figure
11 be different?

12 A If you take our numbers
13 92 and 136, I think that comes to about 31 percent,
14 Mr. Bayly.

15 Q So you would contemplate
16 there might be an additional 5 percent over the top
17 figure that Mr. Kosten mentioned, of days when you might
18 not be able to work because of weather conditions,
19 et cetera?

20 A It's --
21 MR. HOLLINGWORTH: IN fairness
22 to Mr. Kosten and perhaps to Mr. Williams as well, Mr.
23 Commissioner, I don't think that Mr. Kosten said 20 to
24 25 percent of the days would be below this figure of
25 35 degrees below zero. He estimated that as the total
26 number of non-productive days, but I don't believe he
27 attributed it solely to weather.

28 MR. BAYLY:

29 Q I'm just checking in that
30 transcript at the same page, Mr. Commissioner, 9784, of

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1 the reference at line 30. The question, and I believe
2 Mr. Hollingworth is right, "What percentage would you
3 have allowed for non-productive days during the days in
4 which you intend to work", so it's not just weather.

5 THE COMMISSIONER: What else
6 did he have in mind?

7 MR. BAYLY: He didn't say, but
8 I didn't pin him just to days during which production
9 would be shut down because of weather, and perhaps Mr.
10 Williams would expand.

11 Q I understand you may have
12 days when your ditcher is shut down and you can't do
13 that kind of work, or there may be labour problems
14 which cause shutdown, but it isn't just weather, I take
15 it, that's gone into your calculation?
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Dau, Williams
Cross-Exam by Bayly

A That's correct it's not just weather.

1 That is the difference - I'm
2 talking about our numbers. the difference between 136
3 and 92.

4 Q Yes.

5 THE COMMISSIONER: Well one
6 thing though Mr. Dau made clear when he gave evidence,
7 whenever it was, May or sometime that in your estimate,
8 you're talking about weather and break down of machinery
9 but you're not talking about labour relations. No
10 allowance is made for loss of time owing to strikes
11 or lockouts or anything like that.

12 A That's correct sir.

13 MR. BAYLY:

14 Q Is that your understanding
15 Mr. Williams?

16 A Yes sir.

17 Q If I could refer to
18 the transcript again at page 9790 and I was questioning
19 Mr. Kosten here regarding working in December.
20 And the question was, I take it you could work in early
21 December, though given the life conditions then might
22 be similar to the life conditions say at the end of
23 January, the answer was, I believe December is pretty
24 well total darkness for all intents and purposes.

25 Now, would you agree with that,
26 Mr. Williams?

27 A No sir.

28 Q And I take it you've done
29 winter work in the Mackenzie Valley, both at the Sans
30 Sault test site and other places?

1 A Yes.

2 Q And what would be your
3 appraisal of the darkness conditions say at Sans Sault
4 during the month of December?

5 How many effective working
6 hours would you think you would get without lights
7 for example?

8 A Oh, I recall working
9 there on the 22nd of December, about the 22nd, and
10 there would be about four hours, I think, Mr. Bayly.

11 Q And you could work during
12 those hours without the aid of search lights or flood
13 lights?

14 A Four to five yes.

15 Q And have you worked farther
16 down river in the delta at that time of the year and
17 if so could you comment on light conditions at that time
18 of year there?

19 A Well Inuvik's snow road
20 was done about the same time, I didn't spend a lot of
21 time there though personally. I know the pictures that
22 came out are pretty dusky,

23 Q In order to build that
24 snow road, did you use a flood lighting system or did
25 you just use the lights of the vehicles that were doing
26 the construction?

27 A Just the lights of the
28 vehicles and hand flash lights and things like that.

29 Q So you would say that when
30 you get that far down the river, in the later part of

1 December, you are into a situation where it's
2 particularly dark?

3 A Yes sir.

4 Q But not farther up river?

5 A Certainly it varies with
6 latitude, yes.

7 Q Now referring to page
8 9791 of the transcript, again, Mr. Kosten, in answer to
9 a question about temperature, and I won't go into the
10 question because it's one that the Commissioner and I
11 asked over about two pages. but in commenting on the
12 temperature in December, Mr Kosten said, "I suppose
13 there is a possibility of the temperature on a particular
14 day being in an acceptable working condition. I don't
15 deny that. I think the likelihood of any prolonged warm
16 spells such as this, I don't think it's very likely,
17 one day isn't much good to you."

18 Now taking your experience,
19 Mr. Williams, both working in Inuvik on the snow road
20 project and at the Sans Sault test site, would you agree
21 with Mr. Kosten that days when you could work and operate
22 equipment would be pretty limited in December?

23 A No sir.

24 Q What is your experience
25 with regard to the temperatures in December, and if you
26 like, take the two areas separately?

27 A Well in December, I would
28 think that most of the days are below zero degrees
29 Fahrenheit. They can vary down to minus 60, but in
30 December, I would think that, without referring to the

1 temperature charts, that three quarters of the month
2 would be amenable to pipeline construction work.

3 Q And is that in both areas
4 you worked in?

5 A Yes, we had minus 60
6 below temperatures at Sans Sault and the work didn't
7 shut down completely. Some way the work went on, we
8 can weld under shelters and so forth.

9 Q So generally the weather
10 in December didn't shut your operation down very much,
11 even when it was cold, which was not all the time.

12 A No we had -- you know,
13 it's a long time ago and I'm going by my memory, but
14 maybe two or three days in December that we did very
15 little outside work. We were fortunate we could do
16 some inside. We had a building but only two or three
17 days where we shut down completely and at an Inuvik
18 on the snow road work, I don't think -- I don't recall
19 any weather days on that, which is different. There
20 are not that many workmen working out in the elements,
21 they're mostly in covered equipment.

22 MR. BAYLY: Those are all
23 the questions I have thank you.

24 THE COMMISSIONER: Well does
25 that finish up this panel then?

26 MR. GENEST:
27 I would like while Mr. Dau
28 is here to raise the question that arises under
29 the ruling given in Whitehorse as to production of
30 comparable cost figures relating to the -- by line segments

1 relating to the Fairbanks alternative route, and the
2 prime route. Your ruling sir, was made on a motion by
3 Mr. Gibbs which can be found at page 6960 of the trans-
4 cript where Mr. Gibbs said and I quote,

5 "My request sir, is that
6 Arctic Gas produce for the prime route, in the same
7 division of segments as direct costs are listed in
8 Section 10 of their filing, the indirect costs and the
9 interest during construction figures" which is going
10 to be the key figure "for each segment and as well sir
11 that they produce similar figures for the Fairbanks
12 route" and then he goes on to describe the segments.
13 Your ruling sir can be found at page 7057 of the
14 transcript and in essence it says sir, that -- it's
15 at page 7059 I quote "And in the circumstances, I am
16 going to direct Arctic Gas to provide the segmented costs
17 that Mr Gibbs has asked for" and you go on to give the
18 reasons and we -- Mr. Dau who has been concerned with that
19 matter has run into some difficulties about strict
20 compliance with the kind of figure that Mr. Gibbs wants
21 and I ask leave sir to take this opportunity to ask him
22 to explain to you the difficulties and see if we can
23 arrive at a solution that's acceptable.

24 THE COMMISSIONER: All right,
25 let's have a cup of coffee first.

26 (PROCEEDINGS ADJOURNED)
27
28
29
30

1
2 (PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

3
4 THE COMMISSIONER: Well ladies
5 and gentlemen, shall we come to order? Just one hour to
6 go. I keep forgetting it.

7 MR. GOUDGE: Before beginning,
8 Mr. Commissioner, I have spoken to counsel, sir, and
9 subject to what you think is appropriate, counsel are
10 agreed that we perhaps ought not to sit tonight. That's
11 in the interests of one of our witnesses frankly, who
12 has arrived from England and has a seven hour time lag
13 to make up and will be much fresher tomorrow morning,
14 he tells me.

15 We are grateful --

16 THE COMMISSIONER: It sounds
17 reasonable.

18 MR. GOUDGE: -- to other
19 counsel for that. In place of tonight if an evening
20 sitting appears to be necessary to finish what's on
21 our plate for this week, perhaps it could be tomorrow
22 night instead of tonight.

23 THE COMMISSIONER: All right.

24 MR. GENEST: Sir, the other
25 thing before I return to Mr. Dau, I just received the
26 -- a volume entitled Supplement to Applications and
27 Exhibits Relative to Alternative Routing for the Alaska
28 Supply Lateral Across the Mackenzie Delta, which was
29 filed recently with the Minister of Indian Affairs and
30 Northern Development, in which I understand, sir, he

1 has referred to you for consideration. We now have
2 copies, I have distributed I think to all my friends,
3 a copy of the material.

4 I have alongside it, sir, a
5 set of alignment sheets which may but are not necessarily
6 identical to the alignment sheets, the early alignment
7 sheets that we had filed. I understand there are small
8 changes, and perhaps I would like to file those as well
9 and if these could be marked as Exhibits, I would be
10 grateful.

11 THE COMMISSIONER: All right.
12 What number will the book have, Miss Hutchinson? 266.

13
14 (SUPPLEMENT TO APPLICATIONS AND EXHIBITS RELATIVE
15 TO ALTERNATIVE ROUTING FOR THE ALASKA SUPPLY
16 LATERAL ACROSS THE MACKENZIE DELTA MARKED AS
17 EXHIBIT NUMBER 266)

18 (ASSIGNMENT SHEETS MARKED EXHIBIT 267)

19 THE COMMISSIONER: Well it's
20 always nice to get these big thick volumes.

21 MR. GENEST: For the long
22 nights, sir. The winter is coming on.

23 The other thing, sir, is that
24 I think previously you asked us to confirm whether or
25 not in January we would be prepared to produce witnesses
26 to speak to this, and I'm advised that we should be in a
27 position to do so.

28 THE COMMISSIONER: Oh, I see.

29 MR. GENEST: That's for the
30 Cross Delta alternative.

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1 THE COMMISSIONER: Thank you.

2 MR. GENEST: Now sir, I was
3 dealing before the coffee break with the ruling that
4 you had made as to segmented costs and sir, the problem
5 relates specifically to the treatment of indirect costs
6 and in particular, to that portion of indirect costs
7 representing the cost of funds used during construction.
8 Perhaps I could ask Mr. Dau to explain the difficulty we
9 are under to comply with the letter of what Mr. Gibbs
10 requested.

11 Mr. Dau?

12 WITNESS DAU:

13 A Yes, Mr. Genest. The
14 calculation of the funds used during construction is
15 made by a computer or special program, that's -- the
16 basis of the program is the financing plan for the
17 project, and as such, it deals with the different
18 sources of funds in that financing plan. I understand
19 there are four or five different types of funds that
20 bear different costs, and they come in, into the project
21 in different time frames, and to utilize that program
22 for line segments, of which there are 10 or 11, is
23 essentially saying that we would have to have 10 or
24 11 financing plans, and I'm advised by the people that
25 use this program that that's impractical. It just can't
26 be done.

27 What we propose to do is to
28 -- and which can be done easily -- is to calculate the
29 allowance for funds for the total project, and then pro
30 rate that sum of money back to the individual line

Dau, Williams

1 covers another or a subordinated debenture, which
2 carries another interest rate, and then your last funds
3 are your permanent long-term financing funds which carry
4 a lesser interest rate.

5
6 Now, that makes sense over a
7 total project, but to break that down on a segments
8 basis, is in our -- at least we don't have a method of
9 calculating without, as Mr. Dau says, inventing 11 new
10 financial plans, and it also, in our view, sir, produces
11 a result that is not very meaningful because you can't
12 tell, once you start the project, you may start construct-
13 ion up on segment A of the line, but you are also
14 spending money on the engineering of segments B and C,
15 you have got two or three spreads going at once, to take
16 that red equity dollar and the green bank financing
17 dollar and a blue long-term dollar, and try to allocate
18 them to the segments of the line is, in our view, in our
19 financial people's view, really quite impractical.

20 So what we would propose to do
21 is provide the figures, the comparable figures, taking
22 those indirect costs and allocating them to each section
23 pro rating them in proportion to the direct costs.

24 Now that can be done -- it
25 will take us about two weeks, I understand, to get the
26 Fairbanks, but I think -- is that right, Mr. Dau, we
27 can get them, we think in time for the resumption of
28 these hearings, when we will be dealing with that
29 phase?

30 WITNESS DAU:

31 A That's correct, sir.

1 sections. This will not be exactly correct, but it's
2 the best we can do. It will be a close approximation.

3 THE COMMISSIONER: All right,
4 and would you -- at least I say all right subject to
5 hearing Mr. Hollingworth. Would you make sure, and I
6 know you will, that the comparisons are between the
7 current figure for the Arctic Gas' line which I under-
8 stand is 7.1 billion -- I know I am going to be correct
9 because I keep losing track of a billion, and the same
10 figure for the same brought up to date for the Fairbanks
11 route.

12 You will remember when we were
13 in Whitehorse, the comparisons were all out of kilter
14 because the Fairbanks route and the other one hadn't
15 been calculated on the same basis as the --

16 MR. GENEST: We had '73 costs,
17 as I recall, sir, for the Fairbanks route, and I think
18 what we can do is update that up to '74 costs, and give
19 you the '74 figures for the prime route --

20 THE COMMISSIONER: Yes.

21 MR. GENEST: -- and break them
22 down by segments.

23 THE COMMISSIONER: Fine.

24 MR. GENEST: But as I under-
25 stand it, what we can't do without inventing a new
26 computer program, is to break down the cost of funds
27 during construction, which on a total project basis
28 says that you draw down your equity first, that's the first
29 money you spend, and that carries a cost, and then your
30 next kind of money is bank bridge financing, which

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covers another or a subordinated debenture, which carries another interest rate, and then your last funds are your permanent long-term financing funds which carry a lesser interest rate.

Now, that makes sense over a total project, but to break that down on a segments basis, is in our -- at least we don't have a method of calculating without, as Mr. Dau says, inventing 11 new financial plans, and it also, in our view, sir, produces a result that is not very meaningful because you can't tell, once you start the project, you may start construction up on segment A of the line, but you are also spending money on the engineering of segments B and C, you have got two or three spreads going at once, to take that red equity dollar and the green bank financing dollar and a blue long-term dollar, and try to allocate them to the segments of the line is, in our view, in our financial people's view, really quite impractical.

So what we would propose to do is provide the figures, the comparable figures, taking those indirect costs and allocating them to each section pro rating them in proportion to the direct costs.

Now that can be done -- it will take us about two weeks, I understand, to get the Fairbanks, but I think -- is that right, Mr. Dau, we can get them, we think in time for the resumption of these hearings, when we will be dealing with that phase?

WITNESS DAU:

A That's correct, sir.

Dau, Williams

1 MR. GENEST: Am I correct?

2 So that's as much as we can do.

3 Now, I don't think that that gets at what Mr. Gibbs is
4 trying to get, and I don't expect Mr. Hollingworth to
5 respond to that instantly, but --

6 THE COMMISSIONER: Well, why
7 don't we do this? You go ahead and get what it is you
8 are in the position to get --

9 MR. GENEST: Right.

10 THE COMMISSIONER: -- and let
11 Mr. Hollingworth and Mr. Gibbs consider the matter and
12 take whatever position you decide you want to take when
13 we resume two weeks Monday.

14 MR. HOLLINGWORTH: Fine, just
15 so I have it clear. I understand then, Mr. Genest, that
16 you propose taking the total indirect costs and allocat-
17 ing these on a segment by segment basis over both the
18 Fairbanks route and the prime route?

19 MR. GENEST: That's correct,
20 but on a pro rate -- but on a pro rated basis --

21 MR. HOLLINGWORTH: In direct
22 proportion --

23 MR. GENEST: -- not on the
24 basis of the financial plan that was used in calculating
25 indirect costs for the whole project.

26 MR. HOLLINGWORTH: So for
27 instance, for any given spread, the ratio taken would
28 be the ratio of those total costs to the total costs
29 of the project, and the same would be done with indirect
30 costs --

Dau, Williams
Cross-Exam by Goudge

1 MR. GENEST: That's right.

2 MR. HOLLINGWORTH: -- arriving
3 at these figures? Well I would like to go away and
4 consider that, sir.

5 THE COMMISSIONER: Yes. All
6 right. Well, thank you.

7 MR. GOUDGE: Sir, I wonder
8 before the panel leaves, I was speaking with Mr. Will-
9 iams at the break and I think I may have had a misunder-
10 standing as to the tables they presented, and if others
11 did, it might perhaps be worth one question if I could
12 be permitted to clarify it?

13 THE COMMISSIONER: All right.

14
15 CROSS-EXAMINATION BY MR. GOUDGE, CONTINUED:

16
17 Q Mr. Williams, dealing
18 with Table 1, I had assumed that the work day column
19 was the length of construction season as estimated by
20 the individual contractors that you consulted. Is that
21 so or not?

22 WITNESS WILLIAMS:

23 A Well it could be, Mr.
24 Goudge, but it's not necessarily so. The contractors,
25 as we mentioned, were given the total number of miles
26 for the season, and they were to, from that, work out
27 their construction plans. And there are several ways
28 that they can attack that problem, and they haven't
29 told us what they did. I don't think we have that
30 information available, and I don't think we could get it

Dau, Williams
Cr. Exam. by Mr. Goudge

1 without going back to them.

2 Q I see.

3 A But when I say it could be
4 done in more than one way, they could start with column
5 2 and make their best estimate on column 3, how many
6 feet of pipe do they think they can get in that area in
7 one day.

1 That gives the number that
2 would give column five, which is the number of work
3 days that would be required to complete that mileage.
4 That's one way they could go about it. And then make
5 their own assessment of how many down days they would
6 have and add that to column five and get column six.
7 The other way that they could have attacked it is start
8 with column six, the total period that they -- season
9 that they think is available, subtract the number of
10 days that they think they would be lost for weather or
11 other reasons and end up with column five. and
12 working then with column two, arrive at columns three
13 and four. I don't know what they did.

14 Q One last question, Mr.
15 Williams, is it fair to say that as a general matter,
16 your estimate of the number of work days available in
17 a winter construction season is a good deal higher than
18 the estimates of the contractors in the pipeline
19 industry?

20 A The numbers would indicate
21 that Mr. Goudge but again, I don't think you can make
22 that as a firm statement.

THE COMMISSIONER:

23 Q Well you went into that
24 earlier. I think you said that on the present basis of
25 your -- the additional knowledge you have now, you are
26 prepared to justify the estimates you've made. You said
27 you felt the contractors, were they in your shoes now,
28 would agree with you. Is that what you meant?

29 A I think that -- yes, they
30 would agree with us, that work could start earlier. But

Dau, Williams
Cross-Exam by Goudge

1 at the same time, if you give them in this case
2 63 to 71 miles, they may still say that they don't
3 have to start before Christmas, Mr. Commissioner, to
4 get the job done.

5 Q What I'm saying is,
6 those numbers speak for themselves and your estimate
7 of 75 miles is certainly in the upper range. You take
8 into account all the figures given by the contractors.
9 The point you made was on the basis of additional
10 knowledge you've gained, the contractors didn't have them when
11 they made those estimates, you think your 75 miles,
12 I keep wanting to say 75 miles an hour, but 75 miles a
13 winter -- per winter per spread is justified. I just
14 don't think there's much point going into that again,
15 Mr. Goudge unless there's something vital.

16 MR. GOUDGE: I've finished.

17 MR. HOLLINGWORTH: I hate to
18 make this a fragmented afternoon, Mr. Commissioner. I
19 just wonder if I could go back to Mr. Genest's
20 representations. As I understand it you feel it's
21 impossible to provide the figures which the Commissioner
22 ordered in Whitehorse because of the fact that a computer
23 program would have to be devised, is that correct?

24 MR. GENEST: That's my
25 understanding. Using the same financial plan of trying
26 to apply early dollars to each segment.

27 MR. HOLLINGWORTH: Do you
28 have a cost figure for providing such a computer program?

29 WITNESS DAU:

30 A No sir. it took about a

1 year and half to develop the first one.

2 MR. HOLLINGWORTH: And when you
3 speak of 11 computer programs, I assume that they would
4 be substantially the same program but with different
5 inputs?

6 A I don't know, I don't
7 know that.

8 THE COMMISSIONER: Well I think
9 you two gentlemen better step down before somebody
10 else thinks of something.

11 Thank you Mr. Dau, thank you
12 Mr. Williams.

13 (WITNESSES ASIDE)

14 MR. HOLLINGWORTH: Mr.
15 Commissioner, one other tag end, it has been suggested,
16 pointed out that the report of Klohn Leonoff Consultants
17 Limited on Slope Stability which has been referred to
18 in the inquiry has not been made an exhibit, and perhaps
19 it would be advisable to do so. It has also been
20 suggested that the UNIES Limited Report on the Swimming
21 Point Crossing should be made an exhibit and as soon as
22 I procure a copy I shall do so but at the moment, I'd
23 like to file the Klohn Leonoff Report as an exhibit.

24 THE COMMISSIONER: All right,
25 that will be marked then.

26 (KLOHN LEONOFF REPORT ON SLOPE STABILITY MARKED
27 EXHIBIT 268)

28 MR. GOUDGE: Sir, next
29 we've arranged for Mr. Templeton to be recalled in order
30 that he be cross-examined. He was here as you will recall

1 in June and gave his evidence in chief then, and his
2 cross-examination was deferred.

3 MR. GENEST: That as
4 I understand it is cross-examination on matters per-
5 taining to Phase I only. We've gone under that
6 assumption, that's what Mr. Scott informed me of.

7 These are being recalled in-
8 sofar as the report which covers a lot of phases --

9 MR. GOUDGE: Yes, I think
10 that's true because Mr. Templeton will be back anyway
11 in later phases so let's proceed on that basis.

12 MR. GENEST: That will
13 cut my questions to almost nothing sir.

14 CARSON H. TEMPLETON: Recalled

15 THE COMMISSIONER: You're
16 entitled to go first Mr. Genest.

17 MR. GENEST: Well, I think
18 I'm entitled to go last. It raises a question. I
19 thought we had settled it at that meeting in Toronto
20 early on, that when evidence of parties other than
21 Arctic Gas was being called, we would be last in order
22 of cross-examination. Mr. Scott, who unfortunately is not
23 here this afternoon, has the same recollection with
24 reservations as to the -- of course the interests of the
25 parties who are cross-examining the witness. I think
26 what the courts do is to avoid, to try and be fair, and
27 avoid sandwiching people who are opposite in interests
28 to a witness who is being called between a friendly cross-
29 examiner who --

30 THE COMMISSIONER: Excuse me
Mr. Genest. If counsel have agreed on the order of

1 examination, that's perfectly all right with me.
2 Even if they haven't, or can't remember having done so,
3 if Mr. Goudge you can suggest an order of cross-
4 examination of Mr. Templeton, that you understand all
5 have agreed to.

6 MR. GENEST: Sir, if I could
7 just interject one more, there is a reference to that,
8 I forgot to bring the volume. it's in the transcript,
9 in the early days of the hearing when we started --
10 Mr. Scott said on the record that the order of cross-
11 examination was as set out in your preliminary ruling,
12 where Foothills was first, followed by Mr. Bayly, Mr.
13 Bell and Mr. Anthony. Essentially the order we followed
14 when Arctic Gas was putting in its evidence. Now what
15 that discussion did not mention, was what happened to
16 Arctic Gas when its own witnesses were not on the stand.

17 MR. HOLLINGWORTH: In order
18 to take into account the fact that Foothills has now
19 become an advocate.

20 MR. GOUDGE: I am in a
21 position that I don't recall any agreement being made
22 although Mr. Scott spoke to me before he left and I
23 think Mr. Genest's point that he ought not to be sand-
24 wached, it makes sense. I haven't spoken to other
25 counsel today so I would suggest and as a scheme to be
26 battled down if somebody doesn't like it that we simply
27 put Mr. Genest at the end and Mr. Hollingworth with him
28 and we move the batting order up accordingly.

29 THE COMMISSIONER: All right.
30 What happens now then?

1 MR. GENEST: Mr. Bayly is
2 drawing a picture of a sandwich.

3 THE COMMISSIONER: Mr. Bell,
4 what about you, Mr Templeton may be leaving.

5 MR. BELL: Subject to what
6 Mr. Goudge would have to say, I would suggest that
7 he go last, I understand that commission counsel---

8
9 MR GENEST: We all
10 agree with that.

11 THE COMMISSIONER: Now we know
12 who goes last. Do we work back from there?

13 MR. GOUDGE: Well I would
14 have thought that in the normal course, we'd start with
15 either Mr. Bell or Mr Bayly.

16 THE COMMISSIONER: Okay.
17 I don't think anybody has any questions, that's why
18 they're all --

19 MR. GENEST: It's a test
20 case.

21 MR. TEMPLETON: I was wondering
22 Mr. Commissioner if I could throw my two bits worth in.

23 I really have some difficulty
24 accepting the environment as being broken down into
25 four phases. I think this was why I asked at the outset
26 that we be able to present our whole case. The environ-
27 ment as I see it is a complex thing that involves con-
28 trols and interactions and -- so that I'm going to have
29 very great difficulty in confining my answers to geo-
30 technical problems.

1 THE COMMISSIONER: You don't
2 have to, Mr. Templeton, as I see it. It seems to me
3 what Mr. Genest is saying that where you gave evidence
4 that challenged the things that his witnesses said in
5 Phase I, he's going to question you. But if your answers
6 are answers that you wish to make complete, as know
7 you will wish to do, then I see nothing wrong with that.
8 These were just convenient compartments and we all
9 understand that it is a continual and not something that
10 you can cut up into little pieces, so don't feel obliged
11 to confine your answers in any way.

12 MR. TEMPLETON: Thank you.
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1 MR. HOLLINGWORTH: Inasmuch
2 as most of the questions have been confined during
3 this phase.

4 THE COMMISSIONER: Well go
5 ahead, Mr. Bell.

6
7 CROSS-EXAMINATION BY MR. BELL:

8
9 Q Well I am tempted to ask
10 Mr. Templeton if he has anything to add, but I'll try
11 and confine myself to matters relating to construction,
12 and I would like to return to a matter which I attempted
13 rather ineptly to canvass with Mr. Dau at one point,
14 when I asked him if there was somebody who had a key to
15 the ditching machine, and nobody quite understood what
16 I was getting at. I would like to perhaps follow up
17 that by asking you, concerning the environmental code
18 which you have put forward here as it relates to
19 construction and the types of restrictions and conditions
20 that would apply to construction, I'm wondering how it's
21 possible to enforce these restrictions and these con-
22 ditions. How do you compel an unwilling applicant or
23 contractor to comply with regulations and restrictions
24 and conditions during construction, when the incentive
25 to keep on going is tremendous. The interest meter is
26 still running as it were, it costs money every moment of
27 delay, and I would like to know if you can offer us any
28 suggestion as to how this could physically possibly be
29 achieved?

30 A I think it's usual in

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1 the construction business to apply some kind of money
2 controls on a contractor, and this may be done by either
3 a performance bond or by a shut-down. In other words,
4 if the owner or the agency looking after it doesn't like
5 what he is doing, he shuts the operation down until
6 things are corrected.

7 But that still comes back to
8 money, because to the contractor a delay is money, and
9 we were faced with this problem in this job, where it's
10 such a tremendous logistics effort to get everything
11 going and to supply the pipelining operation at the
12 head end, that if you shut it down, it's first of all
13 very, very difficult to do. The pressures on the
14 inspector that would shut such an operation down is
15 almost beyond belief that he could really accomplish
16 it.

17 So what we said, to get around
18 the problem, and incidentally if you do shut it down,
19 you have to start piling up things along the way and
20 possibly could cause environmental damage due to the
21 pile-up, so rather than that we suggested in this case
22 that the permittee should be required to post a perform-
23 ance bond equal to one percent of the construction cost.

24 Now that --

25 THE COMMISSIONER: I see, you
26 mean Arctic Gas or Foothills?

27 A Yes, they would post a
28 performance bond with the regulatory authority to equal
29 the one percent of the construction cost. In other
30 words, if it was three billion dollars in the Northwest

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1 Territories and Yukon, they would have to put up a
2 thirty million dollar performance bond that they would
3 live up to the regulations, so that the penalty is
4 basically money, but I really think that all penalties
5 are money when it gets right back to it.

6 THE COMMISSIONER: But how does
7 that -- the point that Mr. Bell makes, it seems to me,
8 is an important one. With the meter running once con-
9 struction begins, and costs piling up, whether construct-
10 ion is proceeding or not, you said yourself the pressure
11 on an environmental inspector who proposes to close the
12 project down anywhere along the route is enormous. I
13 don't quite understand how this one percent performance
14 bond is going to get around that. What good will that
15 do?

16 A Well in addition to the
17 performance bond, they must make good, according to the
18 Code under Section 2.6, to be liable for any of the
19 damages that were caused by --

20 THE COMMISSIONER: I understand
21 that, but you are saying that it is a deterrent based
22 on knowledge that they will have to pay for any damage,
23 that will -- and that that will make it unnecessary for
24 an environmental inspector to shut them down, is that
25 it?

26 A That's right. It's usual
27 in construction contracts to call it liquidated damages
28 for -- in the performance contract business, and the
29 owner, if he makes a claim against a performance bond,
30 it's in that way, and you would make that claim against

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1 the bond for what it might -- for what the costs of that
2 action was.

3 THE COMMISSIONER: But you're
4 then not relying on the exercise of any power that an
5 environmental inspector might have to shut the job down
6 at any given place along the route, on account of a
7 breach by the contractor or one of the sub-contractors
8 of the environmental code?

9 A Well I think that he would
10 have the power to shut it down, but because of the
11 practical difficulties, we wanted to make sure that there
12 was a money thing in addition.

13 THE COMMISSIONER: But you are
14 saying he would have the power to shut it down, but you
15 think it's unlikely he would ever use that power?

16 A Yes, and that it would be
17 a reminder to the applicant and its contractors and sub-
18 contractors that there was a large sum of money sitting
19 in the pot somewhere that the agency could claim if they
20 didn't perform what they were supposed to do.

21 THE COMMISSIONER: I understand.

22 MR. BELL:

23 Q It seems to me that the
24 problem with that, the problem which then arises is the
25 pipeline will pass the cost of the penalty on to the
26 consumer, and thereby avoid paying the penalty. Isn't
27 that the problem with that type of a scheme?

28 A Well some regulatory
29 agencies, and I'm not sure that the National Energy
30 Board does, says that the assets used for rate making

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1 purposes shall be used and useful, prudently acquired,
2 and some agencies --

3 THE COMMISSIONER: Excuse me,
4 used and what?

5 A Prudently acquired.
6 Used and useful, prudently
7 acquired.

8 MR. GENEST: We won't pay for
9 trips to Hawaii.

10 A And so that if the company
11 was negligent, it's possible that it might not be
12 included in rate base for rate making purposes.

13 THE COMMISSIONER: That would
14 have to be excluded from any profit and loss statement
15 or balance sheet used as the basis for calculating rates?
16 And any penalty they had paid?

17 A Well I don't think they
18 use the profit and loss statements.

19 THE COMMISSIONER: Well, what-
20 ever they do use.

21 A Yes, right, it's the rate
22 base --

23 THE COMMISSIONER: Yes, you are
24 saying that they can't throw the million dollar penalty
25 in and ask that the rate be based on the supposition
26 that that was a legitimate expense?

27 A Yes.

28 MR. BELL:

29 Q I take it then, you have
30 not considered the possibility of making the officers

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1 of the company personally liable for any breaches of
2 your code?

3 A No.

4 THE COMMISSIONER: Are you
5 considering that?

6 MR. BELL: I refuse to answer
7 that question.

8 Thank you, that's all I have.

9
10 CROSS-EXAMINATION BY MR. BAYLY:

11
12 Q Mr. Templeton, confining
13 myself to Phase 1 as much as possible, it leaves me
14 with two questions.

15 One is concerning the regulat-
16 ory authority, which I understand you contemplate as
17 having the duty and responsibility of policing the
18 facility and its construction and its operation and main-
19 tenance. Now, am I correct in assuming that you would
20 like to see a single authority rather than a spectrum
21 of government departments, each with a corner of the
22 responsibility?

23 A Definitely.

24 Q And have you thought of
25 the authority in terms of access to it, because I under-
26 stand it would have to be quite a large and probably
27 quite a complex authority, in that it would have to
28 oversee a large number of operations and employ people
29 from probably a large number of disciplines?

30 A Yes, of course, it is a

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1 large operation.

2 Q So it would be quite a
3 large authority in terms of the personnel it would
4 require?

5 A Yes, it would certainly
6 be in the hundreds.

7 Q And it would be a large
8 authority in terms of the number of things it would have
9 to police?

10 A Yes, it would have to
11 police, in my opinion, all of the Acts of the federal
12 government pertaining to the operation, and there's
13 some 40 some.

14 Q Have you thought, Mr.
15 Templeton, about the problems of somebody who wants to
16 bring something to the attention of this authority, say
17 a community along the line which feels that something
18 is going wrong? Will there access to it in some way be
19 different than their present access to say, the
20 Department of Indian Affairs?

21 A I was rather hoping it
22 might be a little closer.

23 Perhaps that's not fair, but
24 the agency would of course have people in the south,
25 but basically it's the southern portion of it would be
26 support for those who are here, are in the north, on
27 the spreads there, and in the central offices, that are
28 whatever the central offices of the pipeline company
29 are, and I would think that they would certainly have
30 to be responsive to the communities in which they are

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1 dealing. I think we said at one place that we were
2 hoping that somebody would write a social code to go
3 along with the environmental code, and that this would
4 be one way in which this interaction would take place.
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1 Q All right so you would
2 anticipate or recommend that this authority would have
3 some machinery for allowing access by people along the
4 line in case they had something to bring to its attention
5 which may have been overlooked by its officers.

6 A Oh, I think that
7 definitely the duty of the regulatory authority.

8 Q And would you, with your
9 experience of regulatory authorities feel that that
10 should be something written into their terms of
11 reference as opposed to being left to practice?

12 A Oh yes.

13 Q And we have heard some
14 rumours that the Department of Indian Affairs may be
15 interested in either forming or being that authority, do
16 you have any opinion on that?

17 A Well I think that there
18 are three government departments who have an interest
19 and the National Energy Board, the Department of
20 Environment, and Indian Affairs and Northern Development.

21 THE COMMISSIONER: You mean
22 the Department of Energy.

23 A Pardon me?

24 Q You said the National
25 Energy Board, you mean the Department of Energy.
26 If you're talking about departments --

27 A Yes, all right. I thank
28 you. There are three departments and in the National
29 Energy -- the Department of Energy, Lands and Resources,
30 has delegated certain responsibilities to the National

1 Energy Board who in turn have some responsibilities.
2 I think that all of them have expertise that is
3 needed. I think it would be impossible for any one
4 department to administer this pipeline themselves. I
5 think they would have to draw on other departments
6 and so, it seems to me unreasonable to even attempt
7 a single department doing it.

8 MR. BAYLY:

9 Q So you would recommend
10 that none of the existing departments be the authority
11 but that, it be something quite separate from them
12 although drawing on their expertise and experience?

13 A Yes, I think it's
14 essential that they draw on their experience, but
15 they can't very well -- I think there's another
16 advantage in that this will be quite a large build
17 up of staff for a very large project which will cause
18 a great deal of disruption to the departments to do.
19 And it seems unreasonable to me that you should -- that
20 anyone department should build up that kind of staff
21 within the civil service set up because it's very
22 difficult to turn it off and I think Mr. Craik
23 discussing this in June said it should have a self
24 destruct mechanism built into it so that the people
25 would be seconded to it from various departments, they
26 would do a job for a limited length of time, and then
27 they would go back to their old department.

28 THE COMMISSIONER:

29 Q Could I ask you a
30 question about that. You're contemplating that such
31 a regulatory authority with the self destruct mechanism

1 would self destruct when? When construction was
2 ended or when the pipeline was abandoned?

3 A No, when the construction
4 was ended and after that, the operations are of a much
5 smaller nature and can be handled by the departments
6 in the course of their regular duties.

7 Q And presumably by the
8 National Energy Board?

9 A Well the National
10 Energy Board would certainly have to look after those
11 things that it normally looks after but there are
12 other things like fisheries and -- that would be under
13 the Department of Environment.

14 Q So your proposed
15 regulatory agency which you're unwilling to -- a
16 function you're unwilling to turn over to any single
17 department of the federal government, but which would
18 draw on the expertise of all three departments,
19 and perhaps to some extent, on the expertise of the
20 National Energy Board as well, would self destruct when
21 construction was completed?

22 A Yes.

23 MR. BAYLY.

24 Q Would you envisage, Mr.
25 Templeton, this authority rising from its own ashes, at
26 some point when looping began?

27 A That's a good question.

28 Yes, I think I have had
29 difficulty with this looping all the time because I
30 can't accept the idea that looping is inevitable. Nor

1 can I accept that it's going to be done at the convenience
2 of the pipeline company because of economic reasons.
3 And that I think it's another project and would be
4 I don't know, either they would at that time reactivate
5 the old agency or there would be expertise available
6 to do it through the National Energy Board or others,
7 but I wouldn't -- I don't think it should be set up
8 with the idea that it is all -- that is going to be
9 there and ready to handle looping.

10 Q And would you agree
11 though that a looping project on a pipeline
12 of this size would be a project of sufficient magnitude
13 to require the possible reforming or forming of a new
14 authority?

15 A I'm not sure because I
16 don't know how far down the line it is that the looping
17 is going to happen, because once again, I don't
18 accept the looping in three or four years, after the
19 first one is finished. But it's possible, you know,
20 the National Energy Board has now interpreted its act
21 in a little different way, I don't think I'll take
22 the time to look up the quotation, but it says that it
23 can consider a number of things and then I think the
24 term other matters in its work. I understand that
25 it is now considering environment as another matter.
26 Now it's possible that sometime down the road they may
27 have the expertise to be able to do that, I don't know.
28 Perhaps they're going to consider social matters as one
29 of the other matters, so that somewhere along the line,
30 they may have the expertise to look after the whole thing.

1 Q If this project was
2 commenced and during its being constructed, an oil
3 pipeline was commenced, do you envisage the authority
4 continuing for the policing of an oil pipeline or
5 does the authority you have to recommend a rather more
6 limited ability to deal with pipelines, in that it could
7 say, only deal with gas pipelines?

8 A I think you would set it
9 up for a gas pipeline only and once again, I don't
10 accept the inevitability of an oil pipeline.

11 Q I'm not asking you to do
12 that, I'm just -- my fear perhaps with your self
13 destructing agency is that things will come along that
14 will persuade people to perpetuate forever.

15 A Well that seems kind of
16 built in to some things, but the conditions of an oil
17 pipeline and the criteria and everything else are
18 quite different than a gas pipeline, mainly to do with
19 the possibility of oil spills and --

20 THE COMMISSIONER: It might
21 be elevated which --

22 A It might be elevated but
23 certainly the drainage to do with -- in the case of an
24 accident, is of utmost importance. The biology is
25 different and everything is different. Now it's true
26 that you might build up a lot of expertise in adminis-
27 tering a large contract like this, but I think the
28 environmental effects are quite different for an oil
29 pipeline than a gas pipeline.

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1 Q And in your opinion,
2 would the authority report to cabinet, or would they
3 report to a super ministry, or have you thought of that?

4 A Well we felt that if
5 anything it would have to report to a cabinet minister,
6 and we didn't feel qualified to say which one.

7 Q Is there a way that you
8 envisage for the public to know what this authority would
9 report?

10 A I'm not sure --

11 Q You said that you had
12 envisaged the authority reporting to a cabinet minister?

13 A Yes.

14 Q Would you envisage some
15 machinery so that the authority would also report to the
16 public, say the way the Auditor General does?

17 A Oh, we suggest a different
18 body to do that. We suggested an environmental auditor
19 group who reported to the public as to the success of
20 the pipeline company and the regulatory agency in pre-
21 serving and protecting the environment, and that it
22 would make periodic and perhaps monthly newsletters as
23 to what it sees is going on. So that if there were things
24 that weren't being done it felt right by either the
25 regulatory agency or the pipeline company, that it would
26 simply put this out into the public press, and let
27 -- it would have no authority, but it would be a very
28 small group of people that would make this review and
29 put out factual newsletters, or whatever you want, to
30 the public.

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1 MR. BAYLY: Those are all the
2 questions I have. Thank you, sir.

3 THE COMMISSIONER: Could I
4 just mention something to you that you might consider?

5 When I was in Alaska in June,
6 General Rollins who heads the Alaska Pipeline office,
7 and some of the people on his staff explained to me how
8 their agency is set up. It is set up within the Depart-
9 ment of the Interior.

10 Now, the Department of the
11 Interior encompasses functions that may well include
12 functions now divided in Canada among the Department of
13 the Environment, Department of Northern Development,
14 and the Department of Energy.

15 At any rate, the Alaska Pipe-
16 line office comes under the Department of the Interior,
17 I'm talking about the federal -- there's a portion of
18 the right-of-way that is administered by the state
19 pipeline office, but General Wallens is the head of
20 this office, the Alaska Pipeline office, reports directly
21 to and has access directly to the Under Secretary of
22 the Interior, the equivalent of the Deputy Minister.

23 He has his own inspectors in
24 each camp, and they live there, and they have the power
25 to shut the project down and I met some of those
26 inspectors in the camps, and they had, from time to time,
27 shut the project down on various spreads. At any rate,
28 the -- you might think about that if you are still with
29 us tomorrow, as I hope you may well be, and comment on
30 it if you wish at that time.

1 A I don't think I am quite
2 with you, sir. About the ability to shut it down?

3 THE COMMISSIONER: Well, you
4 talked about you thought it was not likely that an
5 environmental inspector on this Arctic Gas -Foothills
6 project would exercise his power to shut it down, the
7 pressures would be too great.

8 A Yes.

9 THE COMMISSIONER: So you
10 arrived on a monetary penalty.

11 A Yes.

12 THE COMMISSIONER: I under-
13 stand that, and then you discussed another issue, that
14 is, the regulatory agency, whether it should come under
15 a department, should be independent of any department
16 and so forth. I was just telling you what I had found
17 in Alaska, and so far as the regulatory agency is con-
18 cerned, it comes under one Department, the Department
19 of the Interior. That may not mean very much because
20 the Department of the Interior may be the equivalent of
21 three departments in the Canadian government, because in
22 the U.S. they have fewer cabinet officers than we do.
23 A lot fewer.

24 The other question, the other
25 thing I found out there was that they have these
26 inspectors employed by the Alaska Pipeline office who
27 report to General Rollins and they are in each spread
28 in each camp, and they can shut it down and have done
29 so from time to time, along the route, until say,
30 conditions were appropriate at a salmon stream to cross,

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1 that kind of thing.

2 I am not suggesting I know an
3 awful lot about it, I'm just asking you to -- whether
4 you want to comment on that.

5 A The first question was
6 the Department of Interior does have, I think, statutory
7 control over the federal lands.

8 THE COMMISSIONER: Yes.

9 A The State is in the Act
10 too, because there are state lands, but I don't see how
11 you could do that in Canada because there are statutory
12 requirements for three departments at least, and I
13 realize the cabinet can reassign duties, but to my way
14 of looking at it, and knowing a little bit about those
15 departments, I don't think it's practical to try to do
16 that in Canada, so that the single agency reporting to
17 one minister, in my opinion, is the only practical way
18 to do it.

19 As far as shutting it down is
20 concerned, it's a little different in the summer than
21 the winter. Everything is white and cold and the
22 problems are considerably different in these winter
23 operations, which are entirely contained within a camp,
24 where the contractor or the pipeline company supplies a
25 camp, and everybody gets their logistics from that
26 camp, and it's difficult to see the environment -- you
27 can't get around like they do in Alaska, because a lot
28 of places they have a road, and so it's a pretty diffi-
29 cult thing for that inspector, and he's not going to be
30 alone, of course, but the head inspector at that spread,

1 living in that camp, to be able to say "That's not good
2 enough", and draw that fine line, which is always
3 difficult in a construction operation at any time.
4 There aren't, in Canada, many trained environmental
5 inspectors, and that's a sad thing, but this project is
6 going to train them, and there's going to be a painful
7 process. But you see, this hasn't been done.

8 There are engineers that know
9 how to supervise construction, and there are environ-
10 mentalists that know the environment, but they're not
11 wrapped up in one person and they quite often don't
12 understand each other or their language, and it takes a
13 long time to train environmental inspectors, and
14 although we are suggesting that both the pipeline com-
15 pany and the agency do train their inspectors ahead of
16 time so that they know what they are looking for and
17 how to do it, it's still going to be a very, very diffi-
18 cult time for both the pipeline company and the agency.

19 THE COMMISSIONER: Yes, thank
20 you, thank you.

21 Who is next?

22 MR. HOLLINGWORTH: I guess I
23 am.

24 THE COMMISSIONER: All right.

25 A He seems reluctant.

26 MR. HOLLINGWORTH: I won't be
27 very long.

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Cr. Exam. by Mr. Hollingworth

1 CROSS-EXAMINATION BY MR. HOLLINGWORTH:

2
3 Q Mr. Templeton, in Volume
4 46 of the transcripts, dated June 2nd, 1975, and more
5 particularly on page 6036, you state "We then tried
6 to estimate the chances of success in achieving environ-
7 ment protection in each of these four alternatives. We
8 estimated the first two alternatives in which the
9 environmentalists would be on staff, or as consultants
10 could be overrideen by the -- "

11 MR. GENEST: Would you slow
12 down a little so I can hear?

13 MR. HOLLINGWORTH: I'm sorry.

14 THE COMMISSIONER: Sorry, did
15 you say 6036?

16 MR. HOLLINGWORTH: Yes, sir.

17 THE COMMISSIONER: Oh, we
18 then tried to estimate, right. Start there then if you
19 would.

20 MR. HOLLINGWORTH:

21 Q I will start over again
22 then. "We then tried to estimate the chances of success
23 in achieving environment protection in each of these
24 four alternatives. We estimated the first two alter-
25 natives in which the environmentalists would be on staff
26 or as consultants, could be overridden by the hierarchy
27 of financiers, managers, designers, pipeliners, contract-
28 ors, transportation companies and labour unions. This
29 has happened many times in my experience, and I found
30 that if an environmentalist makes too much noise about

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1 his concern that he soon gets his terms of reference
2 changed to silence him. By the way, I wasn't referring
3 in that context to Canadian Arctic Gas Study Limited,
4 because they weren't formed at that time".
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1 This question is getting as
2 long as some others we've heard in this inquiry.

3 I wonder sir, if there is
4 an implication there that either Alberta Gas Trunk Line
5 Limited or Gas Arctic, the predecessors of Canadian
6 Arctic Gas Study Limited in your experience, have in
7 fact, tried to change your terms of reference?

8 A No, I'm sorry if that
9 inference can be drawn from that. In no way do I
10 suggest that they tried to change our terms of
11 reference. They I think I said earlier, Alberta Gas
12 Trunk Line had gone with the concept of an autonomous
13 independent board at the outset and I think probably
14 Mr. Blair was quite instrumental in keeping it going
15 for a number of years until it got into the Canadian
16 Arctic Gas system. I don't infer at all that anybody
17 tried to change our terms of reference.

18 Q I just wanted to clarify
19 that. 'That's all I wanted to ask you. Thank you.

20 CROSS-EXAMINATION BY MR. GENEST:

21 Q Mr. Templeton I just
22 wanted to explore this performance bond idea of yours
23 a little more to see if I can understand how you envisage
24 it would work. You suggest the amount of one percent
25 of construction costs.

26 A Yes.

27 Q And I take it you suggest
28 that the cost of that bond, the cost of obtaining the
29 bond, be included in the constructor's costs.

30 A It's usual.

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Cross-Exam by Genest

1 Q He would pay for it.

2 A It would depend on the
3 regulatory people that set the rate base but it's
4 usual.

5 Q And it would be the
6 cost in the Northwest Territories that's how you
7 envisage it?

8 A Yes.

9 Q Would you separate this
10 regulatory authority as far as its jurisdiction over
11 the line is concerned, at the 60th North parallel,
12 would you have another body look after these concerns
13 south of 60?

14 A Well it may well have to
15 because of the way the laws are set up. The permit
16 here is through the Department of Indian Affairs and
17 Northern Development lands and so when you get to
18 Alberta it's a different --

19 Q It's under the
20 National Energy Board, they're both up here they're
21 under the jurisdiction of both the National Energy
22 Board and the Minister of Northern Affairs.

23 A Yes.

24 Q They can't go ahead on
25 a permit with the certificate from the Board?

26 A That's right and you can't
27 go ahead up here without the -- some kind of permit from
28 the Minister of Indian Affairs and Northern Development.

29 Q Would you not consider
30 desirable sir, that one authority whatever it is, have

1 jurisdiction over the entire project?

2 A There may be some
3 advantages to that'.

4 Q For instance, extending
5 the authority of the regulatory body that you propose
6 not only on construction, north of 60, but also
7 elsewhere in Canada?

8 A Yes, I don't see any
9 reason why there necessarily has to be the same one
10 or that one way or another, I don't think it's that
11 significant. Supposing the National Energy Board was
12 the agency for looking after everything in Alberta.
13 I shouldn't say everything because I guess the other
14 departments for example, Environment and -- would have
15 certain duties as well. They certainly have to do
16 with fish in Alberta, don't they and there probably
17 are a number of other acts that would come into play
18 in Alberta. But I don't see any real reason why you
19 couldn't have an agency in the Northwest Territories
20 and the Yukon and a complementary agency perhaps of a
21 different nature to some degree in Alberta and
22 Saskatchewan..

23 Q Let's see if I can get
24 at this another way Mr. Templeton. Did I understand
25 the thrust of your evidence in chief correctly to be
26 this. That it's important that there be one agency.
27 that authority in the north at least not be scattered
28 amongst several departments who may be working at odds
29 with each other?

30 A Yes.

1 Q I think Mr. Horte gave
2 evidence to the same effect that there should be one
3 place where the buck stops.

4 A Yes, I object to that
5 the buck stopping business but I agree to one agency.
6 He I think went further and said it should be the
7 National Energy Board.

8 Q All right, leaving the
9 nature of the identity of the body aside, do you agree
10 that one of the reasons why you propose such an agency
11 is to avoid concurrent jurisdictions of two or three
12 bodies who are competing with each other, where you
13 can't get a decision.

14 A Yes.

15 Q And would that problem
16 sir not exist if you stopped the authority of this
17 line at the 60th parallel, or the authority of this
18 body, this regulatory body at the 60th parallel. Would
19 you not then run into the problems that you're talking
20 about, that there are a whole new set of rules, might
21 be -- a whole set of conflicts might apply south of 60
22 but wouldn't apply north of 60.

23 A I think they're going to
24 apply anyway because there are Alberta laws and
25 Saskatchewan laws and Department of Indian Affairs and
26 Northern Development does not have that same jurisdiction,
27 so you're faced with that anyway.

28 Q Well sir, we're faced
29 right now with concurrent authority of three departments.
30 Right here in the north, are we not?

1 A Yes.

2 Q And what you propose is
3 that that authority be surrendered to another body, that
4 will draw on the fields of interest of those three
5 departments?

6 A Well, either it's another
7 body or it's a joint body, yes.

8 Q So you want to interfere
9 with or change the existing structures of control in
10 the north?

11 A For this project, yes.

12 Q Well then I can't under-
13 stand why you don't regard that as an objection to your
14 regulatory authority in the north, but you say it's
15 fine in the south, to keep the existing conflict.

16 THE COMMISSIONER. I think
17 he's saying he can't do anything about it in the south
18 without calling a Federal Provincial Conference

19 MR. GENEST: He can do something
20 about it in the federal sphere. Let's leave the
21 provincial jurisdiction aside.

22 A Oh I see, you say let's let
23 one federal agency look after all the federal laws, that
24 would be -- I'm just trying to think. I don't know
25 where I'm going to find that.

26 Q Much as they would
27 in the Northwest Territories.

28 A Well I don't think the
29 same laws apply necessarily in the Northwest Territories
30 as in Alberta. Maybe I'm getting out of my depth here,

1 but Alberta has a whole different -- has a whole set
2 of environmental regulations.

3 Q Mr. Templeton, I'm
4 sorry, I may be confusing you. I'm trying to keep the
5 provincial jurisdiction out of the picture.

6 A Yes, but I don't know
7 how you can because some laws are administered by
8 provincial departments, and they're a federal law and
9 -- Isn't that right. there's some things to do with
10 water that are done that way.

11 MR. GENEST: Mr
12 Templeton threatened that he would turn this into a
13 cross-examination of me.

14 THE COMMISSIONER: The kind
15 of thing you were thinking of applies to road transport.
16 where the Federal Government has deposited regulatory
17 powers with provincial agencies across the country, that
18 does occur.

19 A Yes.
20 THE COMMISSIONER:
21 You have effectively
22 evaded dealing with the question, which I can't even
23 remember now.

24 MR. GENEST: The thrust of
25 my question, Mr. Commissioner, is whether or not
26 Dr. -- I'm sorry, he behaves like a doctor. he's got
27 the learning of a doctor and I keep referring to him
28 as Dr. Mr Templeton, would agree that if there is
29 going to be a body that -- a special body in whom
jurisdiction is placed, to oversee the construction
of this pipeline from a federal jurisdictional point of
view, would it not be better that that body have
authority over the whole project.

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1 From the Yukon border to the
2 49th parallel?

3 A It would be better, if
4 all things were equal, I really have difficulties
5 comprehending all the problems in the provinces.

6 Q All right. Mr. Templeton,
7 this started out to be a question about bonds, and I
8 don't know how I got into that, but I will try and get
9 back on the track.

10 A You have the ability to
11 make speeches, Mr. Genest. It causes everybody
12 trouble.

13 Q The bond that you're
14 speaking of, sir, I just have a little difficulty in
15 envisaging how you contemplate it would work. You say
16 you have an environmental inspector who would be --
17 who would have a lot of pressure on him not to stop
18 the work, so that the bond would put the pressure on
19 everybody involved, financially?

20 A Yes.

21 Q Now I follow you so far.
22 What I don't follow is how would that bond be conditioned,
23 as lawyers say, what would cause a forfeit of all or a
24 portion of the bond?

25 A Well I think to give one
26 very simple example would be if all terrain or we'll
27 say skidoos were used and allowed people to go out and
28 these are company vehicles, or that the company allowed
29 these vehicles to be taken to the construction site,
30 they were used to go out and harass or kill or chase

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1 caribou, that it's quite possible that some kind of
2 levy would be made against the company, and against the
3 bond.

4 Q Would that levy be
5 proportioned to the degree of damage or injury caused
6 by the breach of whatever environmental regulation
7 that occurred?

8 A Yes, I think you have to
9 prove in any performance bond, you have to prove what
10 was done, but I don't think that I would accept the
11 idea, for example, if you were running on winter roads
12 too late in the spring and you got to a trench, or you
13 made a trench because the snow road had been removed
14 and you went over somewhere else, I assume that it isn't
15 just the merchantable timber that would be levied against
16 you, it's what you have done to the environment is what
17 I would try to do, but --

18 Q But you say, you know,
19 that this would be in addition to requiring the repairing
20 or the making good of any damage, and what I have
21 difficulty grasping is once you have done, you have
22 forced the contractor to make good the damage he has
23 caused, what additional penalty and how would the
24 additional penalty that's put out in the bond, what
25 would that be related to?

26 A Well you can't
27 repair some of the things. You can't grow the veget-
28 ation, you can't grow a caribou, and you can't repair
29 an antiquity. I don't know you levy a charge
30 against that, but you could be sure that I could argue

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1 very hard, so --

2 Q Well I'm just interested
3 in your ideas, Mr. Templeton. Would you drop the whole
4 thirty million dollars if you ran into an arrowhead
5 when you weren't supposed to?

6 A Oh no. No, you have to
7 -- I think on any performance bond you have to establish
8 what's been done, but I don't recognize the -- that
9 you have the ability to replace it. You can't replace
10 --

11 Q But you have to put some
12 monetary value, by the very nature of your bond, you have
13 to put a monetary value on that irreplaceable piece of
14 pottery or --

15 A That's right, that's
16 right.

17 Q -- what have you?

18 A That's correct.

19 Q And how would you go about
20 doing that?

21 A Well I think you do it,
22 you would probably end up in court perhaps, I don't
23 know.

24 Q You haven't evolved a
25 plan to that degree of fineness?

26 A No.

27 THE COMMISSIONER: There was
28 an example given by an archaeologist who gave evidence
29 in Whitehorse, you must know his name.

A Morlan .

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1 THE COMMISSIONER: Morlan ,
2 who discussed how on the banks of the rivers in the Yukon
3 where the north was never glaciated, the strata revealed
4 in a quite remarkable way, the history of the people who
5 came from Asia to North America, as long ago as 30,000
6 years, and he told about a bulldozer making a cut, and
7 erasing in perhaps 5 minutes, a very important archae-
8 ological area on one of these river banks.

9 That would be something for
10 which there would have to be presumably a severe penalty,
11 and it is the kind of thing that no one can quantify.
12 It's an intangible, but nevertheless you have to try.
13 That's I suppose what you are telling us, and you might
14 insist upon a very high monetary penalty.

15 A That's right.

16 MR. GENEST:

17 Q Well again could I pursue
18 this?

19 THE COMMISSIONER: Yes.

20 MR. GENEST: I will just be
21 about another two minutes.

22 THE COMMISSIONER: No, go
23 right ahead.

24 MR. GENEST:

25 Q Using Dr. Commissioner's
26 example, if that had been done by a bulldozer operator
27 who was clearly disobeying instructions, explicit
28 instructions given him by the company, he was off on a
29 frolic of his own as some of the old cases say, would
30 you assess the company with that damage? It's a fine

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1 in reality that you're imposing, because it is unquanti-
2 fiable, so you set a level of fines, as I would under-
3 stand it.

4 A I suppose in these
5 things, like everything else, you have to use some
6 judgment about whether the company had done a reasonable
7 job of conducting its operations and living up to its
8 commitments, and if it hadn't, and they hadn't paid any
9 attention, I would be certainly wanting to levy it against
10 the company.

11 Q If they had been negligent
12 in supervising --

13 A Well I am not sure -- I
14 always have difficulties with what negligent means, and
15 --

16 Q Join the club.

17 A -- but I think that --

18 Q Mr. Marshall says that's
19 kept lawyers and judges alive for years.

20 A But anyway, if they had
21 done what I suppose when they come to judge this cost,
22 if it was a reasonable -- if they certainly tried and
23 had done everything possible I suppose it might not be
24 done, but that is true of all performance bonds, isn't
25 it?

26 Q There he goes cross-
27 examining me again. I have got to answer I don't know.
28 Some are stricter than others.

29 I just have one more question,
30 Mr. Templeton. Mr. -- and I just want to talk about

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1 the composition of the Environment Protection Board just
2 for a moment. Dr. Thompson on that Board, was he the
3 geotechnical representative, do I understand that
4 correctly?

5 A Well we didn't consider
6 any member of the Board exclusively in a single discip-
7 line. I think I tried to explain that we tried to look
8 for T-shaped men, one with one strong discipline and a
9 broad view of others --

10 Q Well accepting that,
11 accepting Dr. Thompson's T-shape, --

12 A It was Dr. Wilinoski
13 that objected to his shape.

14 Q The vertical bar would
15 be geotechnical, in the geotechnical area, is that
16 right?

17 A Yes, yes.

18 Q And I just wanted to know,
19 Mr. -- is it Dr. Adam? Dr. Adam, who gave us evidence
20 on snow roads and so on, was as I understand it, not a
21 member of the Board but directed by the Board to carry
22 out the study he did?

23 A That's right.

24 Q And his report was to the
25 Board?

26 A Yes.

27 Q And can you tell me, sir,
28 whether it was approved by Dr. Thompson?

29 A Well it was approved
30 because all of the reports were approved by all of the

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1 Board members, and the report is unanimously signed by
2 all of the Board members.

3 I imagine that there are items
4 in each of the technical reports which is contained in
5 the appendices to the interim reports and also the
6 final report, that some Board member might not agree
7 wholeheartedly with some detail.

8 Q Well what I am trying to
9 get, sir, is whether Dr. Thompson agrees wholeheartedly
10 with Dr. Adam's evidence?

11 A Well he certainly --

12 Q Can you help me on that?

13 A -- agrees with the report,
14 because he signed it, and Adam's report is an appendix
15 in Volume 4.

16 Q Well by the report you
17 mean the Board's, the Environment Protection Board's
18 total report?

19 A Well Adam's report on
20 winter roads is in that.

21 Q I don't know if I got an
22 answer to my question, Mr. Templeton.

23 Can you tell us, and perhaps
24 you don't know, I am not asking you -- if you don't know,
25 please say so, but I would like to know if you are in
26 a position to assure us that Dr. Thompson has read Dr.
27 Adam's report and is in complete agreement with his
28 conclusions?
29
30

1 A He certainly read it and
2 he is in general agreement. Now I don't know whether
3 I can go any farther than saying in general agreement.
4 He might not be in some respects.

5 MR. GENEST: Thank you sir,
6 those are all the questions I have.

7 What about
8 the reason why Dr. Thompson couldn't appear. Did he
9 go to the United States?

10 A He was in England at
11 the time, and we had a very difficult time getting
12 that group together. We always have difficulties
13 having meetings and as you get all but one, you're
14 sometimes doing well.

15 Q Would there be any
16 problem, Mr. Templeton in getting him to appear?

17 A No, we're quite happy
18 to bring Dr. Thompson and Dr. Brittain if you so
19 request.

20 MR. GENEST: Thank you sir,
21 those are all my questions, Mr. Commissioner.

22 CROSS-EXAMINATION BY MR. GOUDGE:

23 Q I just have two areas
24 Mr. Templeton if I could please, You have spoken a
25 good deal in your evidence and today about the independent
26 agency that you envisage. Do you see it coming under the
27 wing of any particular government department or will
28 it report to Cabinet simply through a Minister?

29 A I think of it as reporting
30 to a Minister.

1 Q Do you agree with me that
2 there's a distinction between an agency reporting to a
3 Minister and reporting through a Minister?

4 A I don't think I know
5 the distinction, no.

6 Q Let me put it to you
7 this way. An agency that reports to a Minister might
8 be said to be a part of a government department, whereas
9 an agency that reports to through a Minister simply uses
10 the Minister as its mouthpiece to Cabinet. Does that
11 distinction make sense to you?

12 A It would be through a
13 Minister that I'm looking to then.

14 THE COMMISSIONER: So that the
15 agency wouldn't be subject to the direction of a Minister,
16 it would be as an independent agency, is that it?

17 A It would be an independent
18 agency reporting through a Minister to the Cabinet. I
19 guess that's it. I'm not too clear on this yet. Isn't
20 the National Energy Board reporting that way? Through
21 an Minister.

22 Q Through as opposed to to.

23 A Yes, well that's what
24 I think should be done in this case.

25 Q I see. Have you given
26 any thought or has your thinking gone far enough to
27 let's say where you think this agency should be located?
28 In the North?

29 A Well I think it has to be
30 a structured agency probably at the locations that the

1 pipeline company uses. In other words you have to have
2 available in the south, technical expertise of a wide
3 range who may not be full time but some would be full
4 time. And then you would have to have and I suppose
5 they would report -- they would have some kind of con-
6 tact with the pipeline company at a certain level and
7 then at the district offices, say Yellowknife, or
8 wherever it was. there would be another group, who would
9 support the people on the job.

10 Q And what about head
11 office?

12 A The head office in
13 Toronto, I'd forget about it.
14 I say that advisedly.

15 Q Now sir, dealing with
16 the second area I'd like to explore with you,
17 -- you have in your research developed and have filed
18 with the inquiry a number of terms and conditions which
19 really appear as volume II of your report.

20 A Yes.

21 Q Let me ask you whether
22 your board went through any methodological exercise in
23 addressing itself to how those terms and conditions
24 ought to be drawn up.

25 A Yes, we spent a great
26 deal of time at this, because we tried to put ourselves
27 in the Commissioner's shoes and say how if we were
28 he, how would we write the terms and conditions which
29 is required in the Order in Council. And we found
30 at the outset a great deal of difficulty and I'm sure

1 that you all have in reading the transcripts of getting
2 down to what is important and what is not important
3 and what is the final figure. You know you get from
4 ornithologists, don't disturb the birds, and you get
5 something from each discipline comes up with, some
6 generalized statements. And it's only when you get
7 down to the actual case of saying well can I fly over
8 it at 10,000 feet without disturbing the birds and
9 he said yes. Then you say all right, how about 5,000
10 and you work him down to the level at which you can
11 allow an overflight. And you have to go through that
12 with every discipline and it's a very soul searching
13 sort of a job even in a small group to force them to
14 come to the conclusion of what you're going to do
15 and not do. If you're talking to a pipeline company
16 and its contractors, you have to be very specific,
17 They understand specifications, they understand codes,
18 and they don't understand scientific reports and generali-
19 zations and if you give them that, they won't pay
20 any attention to them. So if you're going to tell them
21 what to do, and what not to do, you have to say it
22 very specifically. And so, that's how we came to the
23 idea of a code in the first place. Because they under-
24 stand codes and they understand the language of them
25 and so I think, if you're going to write any reports,
26 you have to know who you are that is -- that you're
27 writing from, your base line, where you're from, you
28 have to know who you're writing to. I think you have
29 to have an idea, almost a faith in your mind as to who
30 it is you're writing it to. If you're going to get to

1 him and you need to know in general what you want to
2 say. And we said we're writing this code from the
3 basis of a regulatory agency, because we assume that
4 your terms and conditions, Mr. Commissioner, are going to
5 be passed on to somebody to enforce. So we said,
6 we're not writing for you, we're writing for the
7 regulatory agency and we're writing it for the people
8 in the field and who are making the judgment on the
9 type of equipment and how they're going to do the job
10 and in language that they can understand. So that's
11 how we came to work out a code, because this is the
12 way the industry uses it. You heard a number of
13 references to code CSAZ184, that's a gas pipeline
14 Code and all the pipeliners know that. But it
15 doesn't deal with the environment. So we said that
16 we thought there should be an environmental code, to
17 go along with that, and we really would like to see a
18 social code go along with it, but we weren't in that
19 business so we didn't attempt to draft that. So, I
20 think that you're now at the stage of saying, what
21 are the terms and conditions. I think you told us
22 that in May, that you asked us to draw up our terms
23 and conditions and -- for Phase I and I'd like to see
24 perhaps an experiment tried in doing this because it's
25 a difficult thing to do. I've gone through it and
26 the code that we have suggested, we call it Towards an
27 Environmental Code and we explain pretty carefully that
28 we know it isn't final, we don't want it to be called an
29 Environment Protection Board Code, we'd like you to take
30 the cover off and throw it away and call it the

1 Berger Terms and Conditions if you would and take it
2 and work with it. I think you quite often need a first
3 draft so that you can throw it out or mend it or do
4 whatever you want to. I would like to see that
5 Berger Terms and Conditions volume developed with
6 perhaps starting with the framework that we have
7 provided, as the means and if you find that it isn't
8 workable to throw it out.

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1 But to start to add to it the
2 terms and conditions that have come out of the hearings
3 to date on Phase 1, and we recognize that there will be
4 other things that come up later that may modify that,
5 but it's a lot easier to go back and modify it than to
6 wait until the end and you end up with a stack of trans-
7 cripts as high as your head, and try to sort out all of
8 those things out of that on any particular subject.

9 I think the drafting of the
10 terms and conditions in specific terms is a very useful
11 exercise, and I think it's going to speed up the rest
12 of the operation, because then we will be knowing what
13 we are shooting for. We will be knowing, we will be
14 almost having in mind when we are discussing a point,
15 about say caribou, what it is precisely that we are going
16 to be looking for, and we'll be having in mind the
17 paragraph that is going to spell the specification of
18 what you are going to do and not do.

19 Did I make my speech, Mr.
20 Goudge, or would you like some more?

21 Q I'm not sure what the
22 question was.

23 THE COMMISSIONER: Well I
24 think that's good advice, Mr. Templeton, and I think
25 Commission counsel and Dr. Fyles and his staff will be
26 proceeding along lines very close to those you
27 suggested.

28 Well any more questions?

29 MR. GOUDGE: With some trepi-
30 dation, one more question, sir.

1 A How long would
2 you like the answer?

3 Q What I was driving at,
4 Mr. Templeton, was in designing terms or conditions,
5 do you agree that the designer of the term or condition
6 accepts a greater degree of responsibility, the more
7 precisely the term or condition is drawn?

8 Is that a generalization you
9 would agree with?

10 A Yes, I think so.

11 Q Would you agree that the
12 reason for that is that the more precisely it's drawn,
13 the less responsibility the complier with the condition
14 takes?

15 A Yes.

16 Q Would you -- did
17 you make any -- was that a consideration, was that a
18 factor that you put in the scales in the drawing of your
19 code?

20 A Yes, I think we said in
21 the introduction -- I won't read it, but I think we
22 said that what we are trying to do is to spell out the
23 performance needed. We consider a performance code
24 rather than -- we don't think that it's right -- I
25 don't know whether "right" is the correct word. We
26 don't think that you should draw a detailed code to tell
27 the pipeline company how to do it. We should say we
28 could try to restrict ourselves as much as we can, to
29 the performance that we feel is needed.

30 I should

C. H. Templeton
Cr. Exam. by Mr. Goudge

1 mention that we have mentioned always in this discussion
2 the Code, or the terms or conditions which would apply
3 to the whole pipeline, but there are many site specific
4 requirements as well, and for example, you might allow
5 the mining of gravel on one gravel bar, but not on
6 another because the gravel bar might be used as a staging
7 area for geese. So you have to draw a code for the
8 general things, and I think you have to draw -- well
9 our method was to take an Atlas and show with a flag
10 right at that particular spot, no removal of gravel,
11 and this is -- we chose the way of demonstrating as
12 much as we could by graphic means rather than words,
13 and I think that's a good thing to do when you are
14 talking to construction people.

15 So that --

16 MR. GOUDGE: The same could be
17 said of lawyers.

18 A I didn't hear
19 the comment, but I can imagine what it is.

20 MR. GOUDGE:

21 Q Have you
22 finished?

23 A For now.

24 Q Finally, the
25 site specific matters that you feel need to be dealt
26 with, do you conceive of them as being departures from
27 or exceptions to the general code?

28 A Well I think
29 they are supplementary. I think the code would cover
30 all aspects, but there are additional site specific

C.H. Templeton
Cr. Exam. by Mr. Goudge

1 requirements that should be in the Atlas.

2 I wouldn't like to say that
3 you shall never remove any gravel from gravel bars, in
4 the code, because I don't think that would be right,
5 but I would like to say in the Atlas that certain
6 gravel bars should not be used.

7 MR. GOUDGE: I see. Thank you,
8 sir. Those are all the questions I have, Mr.
9 Commissioner.

10 THE COMMISSIONER: Well, thank
11 you very much, Mr. Templeton. If you are going to be
12 around tomorrow morning, I was going to look at my
13 notes of your evidence given in June, but I couldn't
14 -- I didn't locate them, but if you are here in the
15 morning, I might have a few questions, if you don't
16 mind.

17 MR. TEMPLETON: I would be
18 glad to.

19 MR. GOUDGE: 9:00 o'clock, sir,
20 tomorrow morning?

21 THE COMMISSIONER: 9:00 o'clock
22 in the morning then.

23
24 (PROCEEDINGS ADJOURNED TO THURSDAY, SEPTEMBER
25 25TH, 1975 AT 9:00 A.M.)
26
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Vol. 68

Mackenzie Valley pipeline inquiry:

Vol. 68 24 September
1975

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Vol. 68



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MACKENZIE VALLEY PIPELINE INQUIRY

IN THE MATTER OF APPLICATIONS BY EACH OF

- (a) CANADIAN ARCTIC GAS PIPELINE LIMITED FOR A RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS CROWN LANDS WITHIN THE YUKON TERRITORY AND THE NORTHWEST TERRITORIES; and
- (b) FOOTHILLS PIPE LINES LTD. FOR A RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS CROWN LANDS WITHIN THE NORTHWEST TERRITORIES,

FOR THE PURPOSE OF A PROPOSED MACKENZIE VALLEY PIPELINE

and

IN THE MATTER OF THE SOCIAL, ENVIRONMENTAL AND ECONOMIC IMPACT REGIONALLY OF THE CONSTRUCTION, OPERATION AND SUBSEQUENT ABANDONMENT OF THE ABOVE PROPOSED PIPELINES

(Before the Honourable Mr. Justice Berger, Commissioner)

Yellowknife, N.W.T.

September 23rd 1975

PROCEEDINGS AT INQUIRY

Volume 69

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APPEARANCES:

Mr. Ian G. Scott, Q.C.
Mr. Stephen T. Goudge,
Mr. Alick Ryder and
Mr. Ian Roland for Mackenzie Valley
Pipeline Inquiry;
Mr. Pierre Genest, Q.C.
Mr. Jack Marshall,
Mr. Darryl Carter, and
for Canadian Arctic Gas
Pipeline Limited;
Mr. Reginald Gibbs, Q.C.
Mr. Alan Hollingworth for Foothills Pipelines
Ltd.;
Mr. Russell Anthony,
Prof, Alastair Lucas for Canadian Arctic
Resources Committee;
Mr. Glen W. Bell and
Mr. Gerry Sutton for Northwest Territories
Indian Brotherhood and
Metis Association of the
Northwest Territories;
Mr. John Bayly for Inuit Tapirisat of
Canada and the
committee for Original
Peoples Entitlement;
Mr. Ron Veale and
Mr. Allen Lueck for the council for the
Yukon Indians
Mr. Carson H. Templeton for Environment Protect-
ion Board;
Mr. David Reesor for Northwest Territories
Association of Muni-
cipalities
Mr. Murray Sigler for Northwest Territories
Chamber of Commerce

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C.H. Templeton

Yellowknife. N.W.T.

September 25, 1975

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

CARSON H. TEMPLETON: Resumed

THE COMMISSIONER: Well we'll

come to order ladies and gentlemen. I have no further questions for you, Mr. Templeton, does anyone else?

Mr. Genest has the right to re-examine.

MR. Gouge: No sir, I asked my question yesterday, and got more than I bargained for.

THE COMMISSIONER: Is there anything you want to add, Mr. Templeton.

MR. TEMPLETON: Well, it just happens that -- I'm sorry about this, but I think the -- I do have a concern. We were talking yesterday about how to write the terms and conditions and how I have gone through this with the preparation of this code and atlas. I am concerned about the time it takes, or took us, and I wonder if it would be as a suggestion, that after you do the terms and conditions of phase I, which you instructed us to do in May, if we wouldn't tackle Phase II with the idea that you write the terms and conditions first and rather than have overview on overview and get -- and then argue it out in the hearing process. It really boils down to the specific terms and conditions that are needed, and that all the rest, if it isn't going to get into a term and conditions, perhaps isn't needed. I think the participants have all done their homework on this and probably could write the terms and conditions now

1 and could perhaps as a suggestion of how to, for the
2 mechanics of doing it, it would be to each of the
3 participants submit to Commission counsel those terms
4 and conditions and they could put them in some kind of
5 order so that they could be put into gradually worked
6 into a volume and then brought, -- circulated and let
7 everybody study them and come back to the hearing and
8 argue them out. I would think that even if that
9 were being done, that process were done rather than
10 introducing each subject in general, that it would
11 take us all our time to get done by March of next year.
12 I suppose there are some things that perhaps should be
13 said that aren't in the terms and conditions, but
14 perhaps those could be tackled later. It seems to me
15 that if we tackled the terms and conditions first
16 we would get right down to the specifics of what we're
17 trying to do.

18 THE COMMISSIONER: Well I
19 think that counsel will take that under advisement.
20 I think that they have your terms and conditions to
21 circulate in advance and to use as a sort of frame of
22 reference for the consideration of evidence in phases
23 II and III, whether we can prevail upon them to prepare
24 additional terms and conditions, that they want to be
25 considered, is another matter. But I know they'll all
26 consider it. Thank you Mr. Templeton.

27 (WITNESS ASIDE)

28 MR. GOUDGE: Sir, we propose
29 to call next, for you, Dr. Peter Williams, a witness
30 called on behalf of Commission counsel.

P.J. Williams
IN Chief

P.J. WILLIAMS: Sworn.

1 DIRECT EXAMINATION BY MR. GOUDGE:

2 Q Yes, Dr. Williams, you
3 have your curriculum vitae in front of you and I will
4 ask you in a moment to go through it briefly if you
5 would please.

6 Mr. Commissioner, I have cir-
7 culated to counsel, the text of Mr. Williams' evidence.
8 It was prepared in July by Dr. Williams. There are some
9 pencilled changes which appear on the copies that you
10 all have. Those changes represent a certain evolution
11 in Dr. Williams' thinking between the time the document
12 was prepared in July and today, and he will be elucidat-
13 ing that as he goes through his evidence.

14 Now Dr. Williams, if you would
15 please, would you tell the Commission a brief outline of
16 your curriculum vitae?

17 WITNESS WILLIAMS:

18 A Yes, I have a Bachelor
19 of Arts and a Master of Arts from Cambridge University,
20 1954 and 1958 respectively. I'm a Philosophy Licentiate,
21 and a Philosophy Doctor of Stockholm University in
22 1969. I carried out graduate studies, 1954 to '57 at
23 Cambridge University and also at Oslo University in
24 Norway.

25 I was a research officer with
26 the Division of Building Research, National Research
27 Council of Canada, '57 to '62, and a Research Fellow at
28 the Norwegian Geotechnical Institute, 1962 to '65,
29 which is under the Norwegian Council for Scientific
30 and Industrial Research.

P.J. Williams
In Chief

I was again a Research Officer in the Geotechnical Section of the Division of Building Research at N.R.C. 1965 to '69. I then became an Associate Professor in the Department of Geography of Carleton University, and in 1971 I was made Professor.

I was engaged from 1957 to 1969 primarily in government research, but also on occasional studies for special projects. From 1969 I have been engaged in teaching and in research in the geotechnical science program at Carleton University, which is a program supported under contract with industry and government sources.

I have been a lecturer at universities in North America, United Kingdom and Scandinavia, and I have some 40 publications in the fields of soil physics, slope stability and especially freezing and thawing of soils. My doctorate in 1969 was awarded on the basis of a published monograph which was entitled "Properties and Behaviour of Freezing Soils".

I'm the designer or co-designer of several instruments and procedures used in laboratory or field investigations of frost action. My current research is concerned with frost penetration, thermal properties of freezing soils, thermodynamics of soil freezing.

I might add to this that I come from England because I am currently at the Scott Polar Research Institute in Cambridge, England, on a year's leave from Carleton University, and I'm engaged

P.J. Williams
In C hief

1 in studies of properties of earth materials at the Scott
2 Polar Research Institute in Cambridge.

3 Q Thank you, Dr. Williams.
4 Now, if you would please, could you turn to the text of
5 your evidence and if you would be good enough to
6 deliver it to the Commission?

7 A Yes, the phenomenon of
8 frost heave is usually understood as occurring when
9 water moves towards a freezing soil such that the freezing
10 soil comes to have considerably more ice, usually in the
11 form of layers, or lenses in it, than the amount of
12 water the soil had before it was frozen. As a consequence
13 of this extra water, that is ice, the freezing
14 ground increases its volume and gives frost heave.

15 Now, the first picture, if we
16 could have that please, simply illustrates this point.
17 The fact that the water moves towards the freezing zone
18 in this way must be due to an affinity or pulling force
19 exerted by the freezing soil on the adjacent water.
20 This has been understood, of course, for many years now
21 and the reasons for the freezing ground having this
22 affinity for water are fairly well understood in general
23 principle from a scientific point of view.

24 It isn't necessary to go into
25 great detail on that point but it will be apparent that
26 we should be apply to apply sufficient force or loads
27 or pressure to the freezing soil to completely overcome
28 these forces which are drawing the water to the soil
29 that it's freezing. That is to say, if we apply
30 sufficient pressure we can simply stop the process.

P. J. Williams
In Chief

1 This pressure, which is illustrated in the next picture
2 please, is of course, what has frequently been referred
3 to as the shut-off or cut-off pressure. You see the ice
4 is not accumulating, extra ice, because the pulling
5 forces have been completely counteracted by the applied
6 shut-off pressure.

7 I want to direct your attention
8 to the processes which are actually going on in the soil,
9 to the nature of the pulling forces, that is the nature
10 of the forces which are trying to pull or hold the
11 water in the freezing soil, because clearly the magni-
12 tude of the shut-off pressure necessary to prevent or
13 reverse the flow of water is determined by the freezing
14 soil's ability to draw in water. The maximum pulling
15 force the soil can exert is ultimately the shut-off
16 pressure. Until perhaps ten years ago, it was rather
17 generally thought that the pulling forces were generated
18 right at the boundary between the frozen and the unfro-
19 zen soil. It was the act of freezing which gave rise to
20 these pulling forces which we have to overcome by
21 applying shut-off pressure if we want to stop the frost
22 heave.

23 Now, people regard frozen
24 ground as a pretty well impenetrable substance, and it
25 seemed most unlikely that the flows of water could
26 continue right up into the frozen ground. The only
27 place where the water and ice could be accumulating,
28 so it seemed, was right at the border of the frozen
29 layer. However, more recently very detailed studies
30 of freezing soils have shown that not all the water

P.J. Williams
In Chief

1 turns to ice as the soil is frozen. Indeed, even at
2 temperatures several degrees below 32 degrees Fahrenheit,
3 quite a lot of water remains unfrozen in many soils.

4 I have tried to illustrate this
5 in the next diagram. It is only a diagram because it
6 isn't really possible to show clearly on a two-dimensional
7 -- oh, this one, pardon me illustrates the old idea that
8 the ice lenses developed only at the boundary between
9 the frozen soil and the unfrozen soil. But as I have
10 said, we now realize that there is water within the
11 frozen soil and if I can have the next picture, I have
12 tried to illustrate this in this diagram, and it's only
13 a diagram because it's a two-dimensional picture of a
14 three-dimensional thing, but what I have tried to show
15 is that around the particles and in small spaces in the
16 frozen ground, there's quite a lot of water and that is
17 the colourless, the blank areas, if you like, and that
18 in the larger spaces between the particles, there's
19 ice. That's the blue coloured stuff.

20 This is roughly the situation
21 that we have in frozen ground, at temperatures of say,
22 25, 27 or 30 degrees Fahrenheit. Now we wonder what
23 all that water is doing there side by side with ice at
24 temperatures below the freezing point, and I think I
25 can only say that the properties of the water are some-
26 what changed, because of their proximity to the small
27 soil particles. It's a complicated business and it
28 doesn't really concern us here.

Most people here are aware of the motion of permeability of soils and an the next picture shows measurements of the permeability. That is the ability of water to move in different kinds of frozen soil. You will see that the permeability or hydraulic conductivity, the values of which are

1 given on the vertical axis, are decreasing as the
2 temperatures falls which is the horizontal axis. The
3 horizontal axis is given in both degrees Centigrade and
4 degrees Fahrenheit, and as the temperature falls, the
5 hydraulic conductivity values are falling.

6 But there is still a significant and measurable hydraulic
7 conductivity several degrees below the normal freezing
8 point of water which is the zero point on the hori-
9 zontal axis.

10 Although there's quite a lot of
11 discussion as to the exact mechanisms of the movement,
12 and the details of the process, it is quite definitely
13 established that water can move in frozen soils.

14 Now the next and most important
15 point I want to raise --

16 THE COMMISSIONER: Excuse me,
17 Dr. Williams, I'm terribly sorry to interrupt you, but
18 are you saying that the water in the frozen soil for
19 reasons that, I think you said were too complicated or
20 something, is not converted to ice, even though that
21 is what you would expect, what all of us would expect.

22 A That's correct.

23 Q And it continues to
24 move?

25 A If it wants to yes.

26 Q If it wants to?

27 A If the circumstances are
28 such as to initiate a movement of water, it will move.

29 The next point I want to raise
30 and the most important is also referring to rather recent

research

1 /and actually it's a large body of research, spread over
2 some ten or more years, relates to the pulling
3 forces which the freezing process generates and which are
4 basic to the whole question of whether frost heave
5 occurs and whether it can be stopped.

6 Now up until fairly recently,
7 these pulling forces, as I said, were believed to be
8 effective at the frost line, the boundary between the
9 frozen and unfrozen soils. That is where the temper-
10 ature 32 Degrees Fahrenheit. But if the water occurs
11 well into the frozen soil, as I have shown, we are
12 faced with a question of whether at the lower temperatures.
13 30 degrees Fahrenheit, 28 or whatever, within the
14 frozen layer, perhaps the water there is subjected to
15 much greater pulling forces. Indeed, it seems to be
16 quite definitely established that this is the case. And
17 in another diagram, the next one please I show a piece
18 of frozen soil, and on the left hand side of the piece
19 of frozen soil, I've listed some temperatures which would
20 quite well exist in that piece of frozen soil, it's
21 a temperature gradient therefore, and on the right hand
22 side I've simply put the magnitude of the pulling forces
23 which are associated with the water at the temperature
24 corresponding.

25 Now the pulling forces are the
26 forces that we're going to have to overcome by applying
27 shut off pressure if we are to completely stop the frost
28 heave. But if this is the situation, as I have shown
29 it here, exactly which pulling force? Which shut off
30 pressure do we have to apply? How does it relate to the

1 values I've shown? How does the shut off pressure relate
2 to the several values I have shown?

3 Well there are many investigators
4 around the world who are in fact studying the same
5 phenomenon. They don't always refer to shut off
6 pressures but there have been many experiments along
7 similar lines and it has been observed rather frequently
8 that it is very hard to define precisely the shut off
9 pressure. That is to say, if a sample is cooled more
10 rapidly or more slowly, or if a test is continued for
11 much longer periods of time, apparently a somewhat
12 different shut off pressure, often much greater, is
13 required to prevent a continuing flow of heave. Faced
14 with this problem of there apparently being different
15 values of shut off pressures depending on the time of
16 freezing, the magnitude of temperature and temperature
17 gradients and so on, investigators have arrived at a
18 consensus of opinion as to what is happening. Under
19 one set of conditions, the pulling force, which is
20 also the expansive force of frost heaving is that for
21 one temperature in the soil, and under different conditions
22 in another part of the soil, a different temperature is
23 effective, and thus there is a greater shut off pressure
24 required. Although the figures we have are rarely
25 sufficient to enable us to predict what will occur under
26 a given set of conditions, it does appear for example,
27 reasonable, that if freezing temperatures are maintained
28 over a very long period of time, then the higher pressure
29 pulling forces, the larger pulling forces, implying the
30 higher shut off pressures, will often become important.

1 They are less effective if only a short time is
2 available because the hydraulic conductivity is much
3 reduced at the lower temperatures and it simply takes
4 a long time for the pulling forces to be transmitted,
5 for the water movement to occur within the frozen soil,
6 and for a significant quantity of water to accumulate
7 and for expansion to thus occur at these high pressures.

8 You will remember, of course,
9 that the water which gives rise to the frost heave when
10 it is turned into ice, largely has its origin outside
11 the frozen layer and it is drawn towards the freezing
12 soil, which I am now saying it enters, but once within
13 the frozen soil, it moves very slowly.

14 If we consider a soil in which the
15 distance is large, between the edge of the frozen soil
16 where we actually are measuring pulling forces, and a
17 point within the frozen soil, with a temperature of
18 say 28 degrees Fahrenheit, it seems reasonable that it
19 would take longer for the effects of the strong pulling
20 force, at the 28 degree Fahrenheit temperature, to be
21 felt. In other words the distribution of the temperatures
22 in the ground and the distance from the border, that is
23 the boundary of the frozen layer, also seems to be
24 important. That is why, if we vary the thermal con-
25 ditions or extend the length of our experiment, we tend
26 to find different shut off pressures are required. We
27 have to apply different pressures usually greater with
28 time, to maintain the state of preventing flow of water
29 into the frozen layer.

30 Actually, to totally prevent

1 heave, we have to extrude water from the freezing layer,
2 and the freezing layer in this case, of course, involves
3 soil at various temperatures. 29, 28 degrees Fahrenheit
4 and so on.

5 Now while we now in a
6 qualitative sense about these phenomena. as yet we
7 do not have enough knowledge of the figures involved to
8 be able to predict very accurately exactly what shut
9 off pressure would be needed for a particular set of
10 circumstances. What we do know, is that experiments
11 carried out over short periods of time, or in a very
12 limited set of thermal conditions, do not often reveal
13 the greatest shut off pressure that may ultimately be
14 required. I emphasize it's quite difficult to predict
15 what ultimate shut off pressures may be required, in
16 particular cases.

1 But the fact that they may be
2 very high is not simply based on hypothesis or theory or
3 an extension from our knowledge of the fact that there
4 is a greater pulling force at a lower temperature. There
5 is some direct experimental evidence.

6 Perhaps the best is from a
7 paper by Hoekstra, written in 1969, and I would like to
8 show two illustrations. The first one which is the
9 next -- pardon me it's the slide, and the first illustra-
10 tion then in this context, is of a series of photographs
11 that Hoekstra took showing the development of an ice
12 lens within the frozen ground, so we know it's not only
13 right at the frost line that water accumulates to get
14 these ice lenses.

15 THE COMMISSIONER: Dr. Williams,
16 the theory as we were given to understand it, was that
17 water was drawn toward the frost front, toward the
18 frozen soil. Then the water drawn toward the frost front
19 was converted to ice at the border, so to speak, and
20 that gave you an expanded volume of matter trying to
21 occupy the space that a more limited volume had occupied
22 so you have got the phenomenon of frost heave.

23 You're saying, as I understand
24 it, that it doesn't just occur there, that water actually
25 may permeate the frozen soil and lenses be created once
26 you have crossed the border?

27 A Exactly.

28 Now in the picture, the frozen
29 it's a soil column, this is taken from a paper and the
30 text of the paper explains that the column of soil which

1 is shown five times in repetitive photographs here, is
2 about two inches or something like that in height, and
3 the upper part of the column in each case is unfrozen
4 soil, and the parts below the arrow that one sees at
5 the side of the column in each case, the part below that
6 is the frozen soil. So we have got frozen soil at the
7 bottom of the column and unfrozen soil at the top.
8 The ice lens is the sort of wiggly thing looking like a
9 graph or something, but it's actually a tenth of a
10 degree in height, and a tenth of an inch, or something
11 like that in height or thickness, and it lies within
12 the frozen soil, because the arrow is always above it.

13 We start at the upper left
14 picture which was taken first, and the ice lens is just
15 within the frozen soil, and then the next picture which
16 is A2, is taken a little while later and the ice lens
17 has grown somewhat, it is also slightly further within
18 the frozen soil, because the frozen layer has become
19 somewhat larger. You see, the frost line has penetrated
20 as we say a bit further, and in A3, the lens -- same
21 lens is even further within the frozen layer, because
22 the frost has penetrated further in. A4 and so on,
23 and the ice lens is getting bigger all the time, but
24 the important thing is that actually the temperature of
25 the ice lens was being made colder, and so each photo-
26 graph is not only successive in time, but the temper-
27 ature of the ice lens is falling. The text explains
28 that.

29 Now, the text says a sequence
30 of photographs of a growing ice lens formed at cold

1 plate temperatures. Now, you can't exactly measure the
2 temperature of the ice lens because you can't get any-
3 thing in there to measure it, but the bottom of the
4 sample constitutes the cold plate, that's where it is
5 being cooled from, and it's quite clear that if the cold
6 plate gets much colder, then the whole column is becoming
7 colder, and the ice lens is getting colder, and you can
8 calculate what the temperature of the ice lens is
9 quite reasonably.

10 Now, Hoekstra didn't have an
11 infinitely long time available for his experiments
12 either, but he nevertheless managed to make measurements
13 of very high heaving pressures. He called them expan-
14 sive pressures, heaving pressures, he didn't use the
15 word shut-off pressure, of course, and -- but these
16 high heaving on expansive pressures are, of course,
17 the shut-off pressure.

18 Now, the next overhead, if I
19 could have that please. The overhead shows the expansive
20 pressure, heaving pressure as developed at the time of
21 the different photographs successively, so that the
22 next picture which will come on in a minute, shows the
23 heaving pressure as a function of the temperature at
24 the ice lens.

25 Now, I did have a slide made of
26 this because I'm directly reproducing what Hoekstra said,
27 but unfortunately the slide didn't get here, so I have
28 copied from Hoekstra's paper by hand, and that's why
29 the units are different. We have got degrees Centigrade,
30 which is what he used, and negative degrees Centigrade,

1 which minus one is about 30 degrees Fahrenheit and so
2 on, and the pressure which is the heaving pressure, is
3 in pounds per square inch. That's rather important,
4 because if you want to make it into pounds per square
5 foot, which is the unit more commonly used by engineer-
6 ing workers, you have to multiply them by 144. And you
7 see, the heaving pressures are very high. As a matter
8 of fact, they are exactly what we would expect, in
9 theory. A very interesting experiment.

10 The heaving pressures, you see,
11 clearly increase as the temperature of the ice lens
12 fell, so there are about 800 pounds per square inch at
13 about minus 4 or so.

14 I might add that Hoekstra was
15 able to do this by having a very sharp temperature grad-
16 ient across his sample. The gradient was such that the
17 temperature varied by several degrees Fahrenheit over
18 an inch or something like that, and of course this is
19 not a natural condition, at least it's not one that
20 one would find very frequently, but it does show that
21 indeed ice lenses form, producing high expansion press-
22 ures and pulling forces, because they are the same thing
23 essentially, and the high values of these forces, expan-
24 sion pressures, shut-off pressures, that have to be
25 applied to counteract the pulling forces. The high
26 values, therefore, of shut-off pressure are as indicated
27 here.

28 His experiment proved the
29 theoretical and experimentally derived relationships
30 that had already been arrived at, theoretically and more

1 indirectly, relating the forces, the temperature and
2 the fact that the water is indeed free to move if only
3 slowly in the frozen soil.

4 So what do all these scientific
5 findings imply for the case of the cold pipeline, which
6 will of course, cause freezing of ground around it, and
7 I'm talking now of points where the pipeline passes
8 through initially unfrozen ground. I want to refer to
9 the long period of time involved. I should be the first
10 to admit that we shall only know precisely what goes on,
11 what kind of ultimate shut-off pressures might be re-
12 quired, how much heave occurs and so on, in the case
13 of the pipeline, after ten, twenty, thirty or as many
14 years as we are interested in. But of course, precisely
15 the same can be said of conclusions which may be drawn
16 by others from their experiments and which, in the case
17 of the experiments which have been described in detail
18 to this Commission, apparently lead to rather substan-
19 tially different conclusions than those which I am
20 inclined to make.

21 It is my opinion that signi-
22 ficant heaving would tend to occur over many years
23 unless it is counteracted by increasingly greater shut-
24 off pressures that is increasingly greater than the
25 values that have been proposed on the basis of the
26 experiments by Northern Engineering Services, described
27 earlier to this Commission.

28 I believe that the upper value
29 for the required shut-off pressures of some 3,000 psf
30 that has been suggested, is unreasonably optimistic for

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1 at least some soils and some sets of conditions. In
2 my view, Northern Engineering Services in their investi-
3 gations have taken a somewhat narrow and strictly
4 empirical view of the subject. Because of the neces-
5 sarily limited time for their experiments, it is not
6 surprising that shut-off pressures of the magnitude they
7 suggested were sufficient in their experiments to reduce
8 the flow of water to the freezing zone very significantly.
9 However, the information I have seen does not convince
10 me that they succeeded in totally stopping the heave
11 in a number of cases, and indeed, examination of some
12 of their data suggests to me that while the freezing
13 process was, as of course would be expected, progress-
14 ively slower and slower as the frost bulb enlarged, the
15 amount of additional ice being included in the frozen
16 soil, in each layer of frozen soil, was actually
17 increasing.

18 That is, although the rate of
19 freezing was slowing and thus the rate of heave becom-
20 ing smaller, over a long period of time each additional
21 layer frozen would have progressively more ice. Again,
22 we can say that if there is virtually no time limit-
23 ation, then we can expect very significant heaves which
24 could only be prevented by much greater shut-off press-
25 ures than those of 3,000 psf or so that are indicated.
26 If, therefore, one admits that on occasion, and after
27 sufficiently long periods of time, larger shut-off press-
28 ures are going to be required or, if they are not
29 achieved, significant heave will occur, then all the
30 problem areas, such as transitions between non-heaving

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1 soils, perhaps rock, and heaving soils, or between earth
2 materials having different rates of heaving, the situat-
3 ion in palsa bogs and so on, are all made somewhat
4 worse.

5 In conclusion, therefore, I
6 would say that particularly where the cold pipeline
7 passes through the discontinuous permafrost zone, that
8 is where it passes through alternately frozen and un-
9 frozen soils, in my view the potential problems are
10 rather greater than indicated from the interpretations
11 which Northern Engineering Services have placed on their
12 own experimental and theoretical work.

1 Q Dr. Williams, you have
2 briefly mentioned situations where large differential
3 heaves may occur. I wonder if you could elaborate
4 on the matter, particularly with reference to the
5 potential pipe deformation in excess of the limits of
6 permissible curvature laid down by CAG. What kinds of
7 situations have the highest potential for differential
8 heave?

9 A Well firstly. I think
10 that one should be aware that the two and a half feet
11 in 100 feet permissible curvature of the pipe can be
12 misleading. I don't think any of the specialists
13 involved really think that there will be a uniform,
14 smooth, slight curvature of the pipe over the 100
15 foot lengths. Rather we are concerned with inflections
16 over relatively short distances, and if one instead
17 talks of three inches in ten feet, one realizes that the
18 guidelines are quite demanding. Now an example of a
19 particularly bad situation would, I believe, be where
20 the pipe rests on bedrock, or perhaps coarse gravels,
21 that is something not very susceptible to heave at all
22 and then moves into very susceptible material, so that
23 one might have a transition from rock and proceeding
24 further into say fine silty material. Now there will
25 be no heave where the pipe lies on the rock, and to ensure
26 that in the first ten feet in the silty area, there not
27 be three inches of heave, that is very difficult. Most
28 people experienced in frost heave certainly wouldn't
29 regard a three inch heave as large and yet this heave
30 must to meet the guidelines be prevented by some means,

1 presumably in the eyes of Northern Engineering Services
2 by application of shut off pressures. To keep differen-
3 tial heave down to three inches in ten feet at points
4 of transition between heave prone material and those
5 not prone to heave at all, is a very demanding
6 requirement.

7 Q Then could you tell us
8 where the water comes from that contributes to the
9 frost heave and in particular, comment on the concept
10 contained in the evidence of the Foothills Engineering
11 and Construction Panel, page 9 of "Water Migrating
12 towards the Freezing Front from the Unfrozen Soil
13 Beneath"?

14 A Well the water providing
15 the heave in the frozen ground has its origin primarily
16 of course, in the adjacent unfrozen ground. In the
17 case of a cold pipeline, the water will move both from
18 below and more especially from points to the side of the
19 pipe, that is not directly below it.

20 Having stressed that, I'd like
21 to point out that one may indeed have heave where the
22 ice lenses are growing solely with water released by
23 compaction of the soil materials. And indeed, one may
24 also have significant heave simply due to contained
25 water, water that is already in the soil. It doesn't
26 have to move to the soil.

27 THE COMMISSIONER: Excuse me,
28 I was trying to read along with you and I -- did I lose
29 you? Forgive me. You commented on the Foothills
30 suggestion about water moving from soil beneath the un-

1 frozen soil, you appear to reject that and then you said,
2 now when freezing is fairly rapid and that's crossed
3 out, where did you go from there?

4 A I'm sorry, I don't
5 reject the idea that water -- did I understand you to
6 say you thought I had rejected it.

7 Q Well, you did lose me,

8 A The water providing
9 frost heave mostly, in general, comes from adjacent un-
10 frozen ground. Now it may be directly below, but if you
11 have got a pipe the thing has got sides as well and it
12 can come sideways as well.

13 Q All right.

14 MR. GOUDGE:

15 Q Then you go over the
16 page, Dr. Williams and continuing your answer, and
17 if you'd pick it up there there please.

18 A Yes, well having stressed
19 that that's the general state of affairs, I would
20 really like to point out that one can have heave where
21 the ice lenses are growing solely with water released
22 by compaction of the soil materials. So as it freezes,
23 water is pulled out from the pores of the soil, to
24 make the lenses but it doesn't really have its origin
25 any distance away, it's simply water that is right there,
26 but it's being pulled from the little pores into the
27 layers of ice.

28 Even more so, we don't
29 actually have to have it in layers of ice, just the
30 freezing of the water right where it finds itself, the

1 water that is already in the soil can or does produce
2 an expansive effect because as everybody knows, when
3 water freezes, there is a ten percent volume increase.

4 this means according to some fairly simply
5 calculations I think, that, for example a 30 foot
6 diameter bulb, frost bulb, around the pipe, could
7 expand enough for this reason alone, to lift the pipe
8 an unacceptable amount, essentially.

9 Differential uplift will
10 occur where ground conditions change substantially in
11 excess of three inches in ten feet permissible, it
12 seems to me, because of the -- in certain cases because
13 of the contained water.

14 Now this last aspect which
15 I've been stressing, isn't exactly frost heave as I
16 defined it initially.

17 Q What you're talking about
18 there Dr. Williams, I take it is the freezing of the
19 water in place?

20 A That's right.

21 Q Just to insert in your
22 prepared evidence I wonder if you could tell us whether
23 in that particular area relating to the freezing of
24 water in place your thinking has evolved over the
25 last short period of time.

26 A Well, when I prepared
27 these notes, back in June or so, I had rather overlooked
28 this. I certainly knew about it, put it that way, but
29 I did the calculations since then and I feel that I'd
30 underestimated this point, so I wanted to bring this in.

1 I've done a bit more thinking.

2 Q I take it that that
3 thinking adds to the importance of the freezing of
4 water in place as a contributor to frost heave?

5 A Well it's an aspect that
6 mustn't be overlooked certainly.

7 Q I wonder if you would
8 consider, what you would consider to be the field
9 situation that would produce the largest heave and what
10 kinds of soil are "worst" and how important the
11 natural ground water head or ground water level is, and
12 if you could tell us about a chilled pipe under a river
13 in that context?

14 A Well when you speak of
15 the largest heave in a field situation, I think it is
16 necessary to accept that clearly a technique can be
17 applied to reduce heave in some degree and the absolutely
18 largest heaves that can occur in nature, can usually
19 be counteracted by quite modest shut off pressures.
20 I think the question really is, --

21 THE COMMISSIONER: Excuse me,
22 do you mind stopping there. We heard this evidence, I
23 think back in May and its not all together easy to
24 recall it. What are the measures that -- Arctic Gas
25 proposed to number them, but what measures do you have
26 in mind that would counteract the frost heave that would
27 induce the appropriate shut off pressure?

28 A With particular reference
29 to the things that could occur naturally, to give a
30 particularly bad situation, if I understand you, right sir?

1 Q Maybe I'm forcing you
2 to -- maybe you're coming to this but you say here,
3 when you speak of the largest heave in a field situation,
4 I think it is necessary to accept that clearly techniques
5 can be applied to reduce heave and the absolutely
6 largest heaves that can occur in nature can usually be
7 counteracted by quite modest shut off pressures.

8 Now are you -- what techniques
9 are you thinking of that need only apparently induce
10 quite modest shut off of pressure to counteract even
11 the largest heave.

12 A Well, strictly speaking,
13 as I understand it, the shut off pressure is an applied
14 pressure to the surface of the ground and that's one way
15 of stopping heave, you only need a reasonable value
16 of shut off pressure. then you put it there, a pile
17 of earth.

18 But there are other ways of
19 stopping frost heave. well known to highway engineers
20 and it might be drainage for example, in highway building.
21 Another thing is just to go round the bad area and
22 don't even tackle it. I mean that's getting over the
23 problem too. But what I'm referring to here about
24 the largest heaves, those of us who study frost heave and
25 this kind of thing, it kind of is a little game we have
26 to find the biggest heave that ever occurred in nature
27 sort of thing and I've seen pictures of frost heave that
28 has occurred in potential highway sites in one winter
29 of five, six feet of solid ice. These are curiosities
30 and in fact, it's rather easy to stop that sort of
thing, to drain the area, or put a little load on, it

1 wouldn't occur.

2 Q Drain it so that water
3 does not move towards the frost frontit moves away
4 somewhere?

5 A Yes, and our drainage is
6 in effect like putting shut off pressure, because you're
7 making it harder for the pulling force to pull the water.
8 It's got a bigger job to do and if it's not up to it,
9 it won't manage to do it.

1 So I think really what the
2 question is is what field situations are likely to
3 produce a requirement for the largest shut-off pressures
4 to maintain a satisfactorily low level of heave. Pardon
5 me, I am not quite sure how far I have come in my
6 answer.

7 Q I think that's where you
8 were, Dr. Williams.

9 A Well let me just say that
10 again then.

11 What are the field situations
12 that are likely to demand that we in fact produce the
13 biggest shut-off pressures that the engineer has got to
14 produce, that's what I'm saying here. Now, the largest
15 shut-off pressures are associated with the freezing of
16 soils at temperatures below 32 degrees Fahrenheit, and
17 that is freezing of the unfrozen water in the frozen
18 soil at some temperature below 32, and it seems on the
19 basis of our current knowledge that the soils that will
20 require the largest shut-off pressures are rather fine-
21 grained clay-rich silts and that kind of material.

22 The situation is a bit differ-
23 ent than that met with in highway construction where
24 the freezing period is limited in time, of course to one
25 winter, and in any case we can't usually apply large
26 shut-off pressures. It's not an engineering way of
27 doing it. There we tend to say that the worst heave
28 will occur in only moderately fine-grained soils, silts
29 for example, but if we are talking about the long-term
30 problems of high shut-off pressure requirements, then I

1 think that finer grained soils which have more unfrozen
2 water at below freezing temperatures, 28, 29 degrees,
3 and therefore a greater possibility for migration of
4 water through the frozen layer, these are the most
5 important soils.

6 Now coming to the next part of
7 your question, again in highway engineering practice, we
8 attribute great importance to the ground water level.
9 IF it's high, the potential for heave is generally
10 greater, but in the pipeline case the problem areas are
11 those with very high pulling forces, requiring a very
12 high shut-off pressure, and these are so high that whether
13 or not the water table is 10 feet higher or lower, is
14 not a very significant thing in relation to these higher
15 pulling forces.

16 In highway practice, the pulling
17 forces we are concerned with are not so great and perhaps
18 I could interject, of course, that highway practice is
19 simply to strip off all the soil that is prone to freez-
20 ing and prone to frost heave, and replace it with sands
21 and gravels and that sort of thing. So the pulling
22 forces can't be so great, and the effects of another 10
23 feet of head in the ground water level can be more
24 important in the highway situation, but for our situa-
25 tion that we are talking about at present with the pipe-
26 line, the effect of another ten feet of head in the
27 ground water level, isn't going to have very much to do
28 with the extreme cases that we are particularly concerned
29 with here.

30 Now, coming to the question of

1 a chilled pipe under a river, this is no doubt a special
2 problem. It seems to me the potential for heave over a
3 relatively short of period of time here is very great,
4 that is to say, the potential is relatively, compared
5 with the non-river situation, greater for the short time
6 period, and of course even greater for the long time
7 period.

8 There is no question of apply-
9 ing shut-off pressures, as I understand it in the river
10 situation, and so perhaps the most dramatic heaves will
11 occur when the rate of freezing is fairly great, and when
12 indeed the head of water represented by the river may
13 aid the heaving process.

14 THE COMMISSIONER: Excuse me,
15 Dr. Williams.

16 A Yes.

17 THE COMMISSIONER: I'm sorry,
18 I'm not quite with you here. I must have -- I am no
19 doubt missing something fundamental, but because you're
20 passing under a river, the -- that means that the ground
21 water table is well above the level of the pipe.

22 A It's the surface of the
23 river, of course.

24 THE COMMISSIONER: Yes. Now
25 that fact aids the heaving process, as I understand your
26 point here?

27 A Yes. I may be appearing
28 to contradict what I have just said, that in the case
29 of the very high shut-off pressures, in normal freezing
30 ground, around the pipeline where the water table is

1 ten feet higher or lower, it doesn't matter much. It
2 makes it a little worse but not much, and then I appear
3 to be saying that in the case of the river, perhaps it
4 is more significant. That's not really what I want to
5 say.

6 It seems to me the problem
7 under the river is a thoroughly messy one. There's water
8 and loose sediments and everything, and in that sense
9 it's worse than the other situation, but strictly
10 speaking, however, contrary to the implication that I
11 think I have made here, the fact that the water table
12 stands at the surface of the river, rather than ten feet
13 lower, isn't all that important. If the river level
14 fell 10 feet, the heave would be just the same, in my
15 view. The problem would be just the same.

16 THE COMMISSIONER: So it's the
17 kind of unstable situation within the soil that consti-
18 tutes the river bed, or lies beneath the river, that's
19 the problem, is it?

20 A Yes, I am not a fluvial
21 hydrologist, and all I'm saying really is that looked
22 at from the point of view of the soil situation rather
23 than the fluvial situation, that it just looks to me as
24 though the river is as bad as anything one could think
25 of where we don't have the river.

26 THE COMMISSIONER: What about
27 -- doesn't the weight of the river itself applied to
28 the soils surrounding the pipe induce a shut-off pres-
29 sure, isn't that the same as piling twenty million tons
30 of dirt on the top of the soil?

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1 A Well now, this is a rather
2 fundamental thing in soil mechanics. It is true that
3 there is a weight or pressure of water, but equally so
4 it's raising the pressure of the water in the pores of
5 the soil, and then we come to these questions of effect-
6 ive stress, which as come up I know in the Commissions'
7 hearing, and it wouldn't do, for example, to make your
8 shut-off pressure devised instead of a berm, say a great
9 water fall, 100 feet deep, it wouldn't do at all.

10 THE COMMISSIONER: I think I --
11 yes, I think I follow you. At any rate, I should assume
12 that the water in the river is not to be equated with
13 berm or anything like that that induces a shut-off
14 pressure, so I'll exclude that from my mind for reasons
15 of -- I'm sure I could better appreciate it if I stopped
16 to think about it, but I don't want to hold you and all
17 these gentlemen up. You have a much more acute appre-
18 ciation of these things than I do.

19 Well, carry on then, sir, I am
20 sorry to interrupt you.

21 A I think I really answered
22 the question because of these additional comments.
23 One really has the same problems under the river only
24 made worse, plus additional problems.

25 MR. GOUDGE:

26 Q Now then, Dr. Williams,
27 do you consider that heave of a chilled pipeline in
28 formerly unfrozen ground can be kept to a manageable
29 level, and if you do, could you tell us what conditions
30 would be --

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1 THE COMMISSIONER: Well excuse
2 me, Mr. Goudge. Just so that there's no misunderstanding
3 about this, you say surely some very special remedial
4 or other design procedures are required in the river
5 crossing situation, to prevent frost heave. Remedial
6 or other design procedures that you haven't found in the
7 Arctic Gas or Foothills' proposals, does that --

8 A Yes, I think that's true to
9 say. I have looked at a number of the reports that
10 relate to the river situation. As I say, that wasn't
11 my prime personal concern, and there may be others that
12 I haven't seen, but I haven't seen any clear statement
13 of a special procedure that is sort of radical and con-
14 vincing that it will work, let's put it that way.

15 But I really haven't given a
16 great deal of consideration to the river crossing pro-
17 blem, and I'm simply saying that the problem is there
18 that one also has in the non-river situation and worse.

19 THE COMMISSIONER: Yes.

20 MR. GOUDGE:

21 Q And Dr. Williams, I
22 wonder if you would go on to tell us whether you do
23 consider that heave of a chilled pipeline in formerly
24 unfrozen ground can be kept to a manageable level, and
25 if so, what conditions would be required to achieve
26 that?

27 A Well there isn't any
28 absolutely fundamental reason from a scientific point
29 of view why it's impossible to stop the pipe being
30 heaved, so I think we have to consider what is regarded

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1 as a manageable level. It seems to me to be essentially
2 a geotechnical, economic and perhaps environmental
3 protection kind of problem. I do believe that I have
4 stressed that on occasion much higher, sometimes
5 impossibly high shut-off pressures would be needed to
6 prevent the heave, and therefore the design procedures
7 or remedial measures will have to be more dramatic,
8 perhaps substantially bigger berms and perhaps much
9 greater excavations and replacements than Northern
10 Engineering Services has implied on the basis of their
11 maximum shut-off pressures.

12 If one accepts that the maximum
13 required shut-off pressures are say two, or even perhaps
14 for or five times as great on occasion than the 3,000
15 psf that Northern Engineering Services proposed, then I
16 think one has to then proceed to some estimate of how
17 often these situations will occur and what design pro-
18 cedures can be used for dealing with such situations and
19 then whether they are acceptable economically and in
20 other respects, and that is, whether the problem is
21 manageable.

22 Q Would you anticipate that
23 ice lenses will build up above the pipe during develop-
24 ment of the frost bulb, and would this cause heaving
25 at the ground surface above the pipe?

26 A Well I don't see any reason
27 why ice lenses won't occur above the pipeline, provided
28 there is water in the vicinity and that the soils are not
29 very dry and unsaturated, and if the ice lenses form
30 then obviously there will be some heave. Clearly one

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1 will have to take measures if one is to avoid such
2 heaves.

3 Q In an area of highly dis-
4 continuous "warm" permafrost, an alternative to the
5 chilled pipeline is a pipeline operated at above freez-
6 ing temperatures. I wonder if you could give us a
7 comparison of the thermal problems that would accompany
8 these two modes and provide your ideas on how to decide
9 where to chill and where to operate above freezing?

10 A Well basically I feel
11 that the problems associated with a cold pipeline when
12 it passes through unfrozen ground are more unpredictable
13 and therefore have greater potential for making engineer-
14 ing problems than the reverse situation of a warm
15 pipeline passing through a piece of frozen ground.

16 In the latter case, we can
17 ultimately, if we have enough ground information, pre-
18 dict how much settlement would occur. Of course it may
19 take quite detailed ground observations, but it's quite
20 feasible to make good predictions.

1 Put unfortunately, as I've
2 stressed our knowledge of the case of freezing initially
3 unfrozen ground, is such that we are not able to make
4 very accurate predictions and at the same time, the
5 worst cases we can visualize, do seem to be very problem-
6 atic from the point of view of solution of the problem
7 Consequently, it doesn't seem logical to have a cold
8 pipeline traversing large lengths of unfrozen ground.
9 In the case of the warm pipeline passing through frozen
10 ground, I might add that geothermal calculations if
11 sufficiently refined, well they could have made a rather
12 good prediction of the depth of thaw. Very detailed
13 attention would have to be given to the input data for
14 the calculations, but even if they're not particularly
15 accurate, a safety factor could be added. In other
16 words, allow for a somewhat greater possible depth of
17 soil and be quite secure in the knowledge that the
18 potential settlement wouldn't exceed a certain amount.

19 On the other hand, when we have
20 the cold pipeline in initially unfrozen ground, we get
21 into the problem areas that I have talked about --
22 problem areas from the scientific point of view, that
23 although we understand in a fairly general way, the
24 orders of magnitude of heaving and shut off pressures,
25 the pulling forces and so on, we are not able to predict
26 with a great deal of certainty exactly what will happen even
27 if we do know the ground conditions with accuracy.

28 Furthermore, the geothermal
29 calculations aren't a great deal of help to us. It
30 appears they would have to be brought to a higher degree

1 of sophistication to, on the one hand, satisfactorily desc-
2 ribe the thermal conditions during freezing closely --
3 the temperature gradients as well as the magnitude of
4 the frost bulb at different times and on the other hand,
5 even if they were so refined, they would then in our
6 present state of knowledge be of limited value in that
7 we are not as yet able to supply such detailed calculations,
8 not as yet able to apply such detailed calculations
9 to giving us more accurate predictions.

10 I'm not able to answer a
11 direct question as to exactly where it would be
12 appropriate to switch from a cold to a warm pipeline.
13 The question involves an intimate knowledge of the
14 terrain conditions, ground conditions and in addition,
15 geotechnical judgment, economic considerations and so
16 forth concerning the relative difficulty of the cold
17 pipeline in warm ground versus the warm pipeline in
18 frozen ground situation, but I would say as a start
19 one assumes it would be better to have a warm pipeline
20 where you have more unfrozen than frozen ground.

21 I must say that the first
22 step towards making a decision as to where to chill and
23 where to operate above freezing temperatures would seem
24 to me to be to give more attention to the problems of
25 maximum shut off pressures and the nature of the freezing
26 process as I have been emphasizing earlier.

27 Q Thank you Dr. Williams.
28 Mr. Commissioner, Dr. Williams will be available for
29 cross-examination.

30 MR. BELL: I have no questions.

1 Mr. Commissioner.

2 THE COMMISSIONER: Mr. Bayly?

3 MR. BAYLY: I may be out of
4 my depth as well Mr. Commissioner.

5 THE COMMISSIONER: You don't
6 want to take the same chances I took?

7 MR. BAYLY: No, sir,
8 I'll let the experts fight this about.

9 MR. HOLLINGWORTH: Could I
10 just have a moment or two to put my notes together,
11 Mr. Commissioner?

12 THE COMMISSIONER: Yes.

13 (PROCEEDINGS ADJOURNED)
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(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

CROSS EXAMINATION BY MR. HOLLINGWORTH: Dr. Williams, I have a number of inquiries arising out of the text of your evidence in chief, and if you would have that before you, I am going to be referring to it from time to time and I would be greatly obliged if you could confine your answers to one or two syllable questions, or answers, because I am very much an amateur in this field.

CROSS-EXAMINATION BY MR. HOLLINGWORTH:

Q Words of one or two syllables. There seem to be two sections to your evidence, both of which start at page 1 and go onward, and I am dealing now with the first section of your evidence, the part which didn't contain the question and answer sequence, and on page 4 of that document, on the very last line, there is a reference to the rates at which water can move in the frozen soil.

Now, I wonder what documents you are relying upon as to establishing the rates. I mean first of all, do you know there are rates, what they are? In various conditions, and if so, what documents are you referring to in that statement?

A Well I will bear in mind your admonition in the beginning and say that our own work done in our laboratory has been published in part

1 in the Canadian Geotechnical Journal, about 9 months ago,
2 I forget the exact date. It's described in much more
3 detail in a thesis which is available at Carleton Uni-
4 versity, of course, a graduate student thesis.

5 There is work carried out by
6 Dr. Harlan which would be supportive to that. There
7 are studies underway --

8 Q He's not on my side.

9 A I beg your pardon?

10 Q He's not on my side.

11 A There are studies underway
12 at Cornell University under Dr. R.D. Miller, who is a
13 very distinguished worker in this field. He hasn't
14 actually published the results, to my knowledge, but he
15 has spoken publicly at the Calgary Symposium in April
16 this year. His values differ somewhat from ours, but
17 I would say that all the people who have looked at this,
18 and there aren't very many of us actually, are in agree-
19 ment of the general order of magnitude.

20 Q Okay. And then on page
21 5, the next page, in the first paragraph you speak of
22 the measurable quantity, several degrees below freezing
23 point.

24 A Sorry, which page is
25 this?

26 Q This is the next page,
27 page 5.

28 A Yes.

29 Q About a third of the way
30 down, you speak of the measurable quantities several

1 degrees below freezing point. What is the measurable
2 quantity you're speaking of there?

3 A Well, you can see it coming
4 through in our experiment, the way it's set up in our
5 laboratory. You can see the --

6 Q Excuse me for interrupt-
7 ing. Do you mean "our", do you mean Carleton University?

8 A Yes, yes.

9 Q Okay.

10 A If you asked me to give
11 a figure to a non-expert, it's rather meaningless, because
12 do you mean per unit cross section area, per time unit,
13 per gradient unit or whatever, you see, but -- I mean
14 we have seen with our own eyes, the water coming
15 through, because the way our experiment is set up, you
16 can see the water going in one end and coming out of
17 the other, with a piece of frozen soil.

18 Q And for a reference,
19 would you direct me to the same papers that you have
20 previously named?

21 A Yes.

22 Q Then again on page 6,
23 the succeeding page, again in the upper section of the
24 page you say, "Indeed it seems to be quite definitely
25 established that this is the case, and in another dia-
26 gram I show a piece of frozen soil", and you then
27 produced a diagram 6 which was a table, I believe.

28 Now, where did that informat-
29 ion come from, Dr. Williams?
30

1 A Well there is large
2 body of evidence about the pulling forces, that exist
3 at the various temperatures below freezing. If I
4 could refer to my own work, through the last ten years,
5 I have measured, in a variety of experiments, which are
6 published in my doctoral, the monograph on which I was
7 awarded a doctorate, including one which directly shows
8 the effect of the pulling force indrawing together
9 a ^{sample} sample soil. There are other papers in that
10 monograph which through different kinds of experiments,
11 lead to the conclusion of certain values and they're
12 mutually compatible.

13 So, we have a certain amount
14 of indirect evidence, but indirect evidence becomes
15 stronger and stronger as you get more of it that points
16 to the same value. What I am trying to say is that
17 of course it is very hard to measure pulling force
18 directly with a gauge, or something like that, in the
19 soil pore, so we have to go to these rather round
20 about methods, but apart from the experimental work,
21 we now understand and by "we" I'm referring to a ^{rather} larger
22 body of scientific workers. the theoretical reason for
23 thermal dynamic equations which tell us just why the
24 pulling forces had these values and these equations are
25 quite basic practical equations.

26 Q Well then you're referring
27 us to a body of classical work as well as to your
28 own doctoral thesis essentially?

29 A Oh yes, yes. My own
30 doctoral thesis is an example of experimental work which

1 demonstrated in the case of soils what the pulling
2 forces are.

3 But we have gradually come to
4 understand and there are many other practical empirical
5 experiments too, that lead to the same kinds of con-
6 clusions that the practical equation, the practical thermal
7 dynamics should have told you that these pulling forces
8 were there.

9 MR. HOLLINGWORTH:
Mr. Goudge, is Dr.

10 Williams's thesis on the list of documents which the
11 Commission has available?

12 MR. GOUDGE: If it isn't
13 there is no doubt that we can provide you with a copy
14 if you like.

15 MR. HOLLINGWORTH: Would you
16 please.

17 Q On page 7, again a third
18 of the way down, you speak of the sample being cooled
19 more rapidly or more slowly. Later on in the paper,
20 you refer us to Hoekstra's experiments which seem to be
21 rapid cooling.

22 A Yes.

23 Q Am I correct in that
24 assumption?

25 A Well, it depends what
26 scales you're referring to with the use of more rapid,
27 less rapid and so on.

28 Q Let me turn that around.
29 You're saying, if a sample is cooled more rapidly or
30 more slowly, my question is more rapidly or more slowly

1 than what?

2 A Yes, that's what I'm
3 referring to too. Hoekstra's experience overall
4 involves rates of freezing that were greater than those
5 that occur in nature. so they're more rapid than occurs
6 in nature on that sort of scale. But, the successive
7 photographs constituted a more rapid freezing within the
8 confines of his scale of rapidity.

9 Q Would you mind going over
10 that again please?

11 A Well, all effective
12 freezings were carried out at rates that were far in
13 excess of those that occur in nature. So we've made a
14 comparison, and we use the term rapid as a relative
15 term between nature and Hoekstra's experiments, but the
16 essence of his experiment was that the more rapidly he
17 cooled it, he's getting higher heaving pressures.

18 Q Right. When you make
19 this statement/^{cooled}more rapidly or more slowly are you saying
20 more rapidly than in nature?

21 A Well, Hoekstra's experiments
22 all done much more rapidly.

23 Q Yes

24 A But, will you be careful
25 not to get confused here, because when we talk about
26 the very long term freezing processes in nature, then
27 we believe that higher heaving pressures, higher
28 shut off pressure is required. That might appear to
29 be a contradiction of Hoekstra's experiments but the point
30 I'm stressing is that there is a dependence on the rate,

1 and in Hoekstra's particular set up, it just happened that
2 he was freezing more rapidly at the time he was
3 getting a greater heating pressure because that made the
4 lens colder. But incidentally, I did say one thing
5 that could have mislead you. I said it was the
6 whole essence of his experiment, that he was freezing
7 it increasingly rapidly. That wasn't the essence of it.
8 It was necessary to freeze it more rapidly in order to
9 get a colder temperature in the ice lens. So it was
10 a technicality.

11 Q On page 8, about two
12 thirds of the way down, you say once within the frozen
13 soil it moves very slowly. You're referring to general
14 studies that have been conducted over the last ten
15 years that you've referred to in making that statement?

16 A Well the fact that the
17 hydraulic conductivity as I've showed in my graph,
18 falls off.

19 Q Yes.

20 A It means that the movements
21 are slow compared with say what happens in unfrozen
22 soil and of course they get slower the colder the frozen
23 soil is.

24 Q On page 10 of your
25 evidence, you refer three quarters of the way down the
26 page, you say "This of course,"--"This is of course
27 not a natural condition, at least not one that we would
28 find frequently." It's not one that we would ever find
29 in nature is it Dr. Williams?

30 A Well, referring only to

1 temperature gradient which he had to establish in order
2 to get his experiment to work, because that was the way
3 the experiment -- I'm sorry I'm not answering your
4 question. You don't get temperature gradients that high
5 in nature except right around the pipe surface may be
6 of course, in the initial stages.

7 Q Are you saying one that
8 we would find frequently apart from around the pipe and
9 the initial stage of the gas transmission, you
10 know of no other situation where you would find such
11 temperature gradients?

12 A Well, on a cold winter
13 day with no snow cover, the wind blowing, you get that
14 kind of thing. It doesn't have any significance to
15 the present discussion if I might say sir.

16 Q Well as I understand the
17 Hoekstra paper deals with the testing in a laboratory
18 of freezing soils in a laboratory in a cylinder and
19 measuring the upward force generated by the expansion
20 force created by the freezing. would that be a fair
21 statement?

22 A Would you mind saying that
23 again?

24 Q The Hoekstra paper deals
25 with testing in the laboratory of freezing soils,
26 particularly fine grained or clay, which is fine grained
27 of course, in a cylinder and measuring the upward force
28 generated by the expansion force created by the freezing.
29 Is that correct?

30 A Yes.

1 Q And its the upward moving
2 water which causes this force?

3 A That isn't quite made
4 clear in Hoekstra's paper. He could be -- no , I
5 think it's the contained water rather. I referred to the
6 fact that even if the water is already there, you can
7 have these expansion pressures.

8 Q Well, it's contained
9 water then within the soil?

10 A Yes. I have this paper
11 here and without reading the paper through, I couldn't
12 be sure, but the values would be the same --

13 Q Regardless. As I
14 understand it, the test was conducted through approximately
15 one inch of clay.

16 A Of that order, yes.

17 Q And the tests varied
18 so that the temperature at the bottom, where the cooling
19 plate was applied, was maintained at temperatures between
20 minus 6.6C. and minus 1.2 C. But the temperature on the
21 top of the sample was always maintained at 5 degrees C.
22 that is plus 5 degrees C.

23 A Well I think your colder
24 temperatures are right and quite likely the plus 5, I
25 don't see that immediately but that --

26 Q Well there was -- I'm
27 referring you to the second page of the test under the
28 heading results and it says --

29 A Yes.

30 Q -- the temperature of the

1 water in the piston was maintained at plus 5 degrees
2 C.

3 A Yes.

4 Q So that you get at least
5 a minimum difference of 6.2 degrees C. over the one
6 inch of clay material? And if you extrapolate that out
7 over a foot, which is a fair thing to do, would you
8 agree with that?

9 A Well you can extrapolate
10 it to anything you like.

11 Q Would you agree with me
12 that if you did extrapolate it out over a foot,
13 that you get a range, a difference of 74.4 degrees
14 C.

15 A Oh, yes, as I said, the
16 gradient is not one which would occur in general in
17 nature.

18 Q And that converted to
19 Fahrenheit would be in the range of 135 degrees

20 A Well I mean, you know,
21 you can talk about gradients, the longer you make the
22 distance, the bigger the difference, but the thing is
23 that over the inch there was a matter of some 12 degrees
24 Fahrenheit.

25 Q And are you aware of
26 the maximum spread per foot in temperatures -- in the
27 temperature isotherms that were observed in the test
28 carried out by Northern Engineering?

29 A Oh yes,

30 Q They were substantially

1 less weren't they?

2 A Well, of course.

3 Q They were in the range

4 of five degrees a foot?

5 A Yes.

6 Q Fahrenheit?

7 A Yes.

8 Q Not 135 degrees.

9 A Nor 270 over two feet.

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1 Q Now carrying on again,
2 looking at your prepared evidence, on page 12 I just
3 wanted to clear up a misunderstanding I seem to have.
4 On page 12 near the bottom, you say "In my view, North-
5 ern Engineering in their investigations have taken a
6 somewhat narrow and strictly empirical view of the
7 subject", and yet on page 11, you say in the middle,
8 "I should be the first to admit that we should only know
9 precisely what goes on and what kind of ultimate shut-
10 off pressures are required after a period of time".
11 Isn't there a conflict between those statements?

12 A No, on the contrary,
13 that's exactly the problem, that if you approach it
14 solely empirically, it's not possible to do the experi-
15 ment properly unless you have got the 30 years to see
16 what happens in, because an empirical approach means
17 that you have got to model in some way what is going on,
18 and the only experiment you could do that would really
19 tell you what would happen would take 30 years.

20 Q Or you could do theoretical
21 studies and speed up that process?

22 A Exactly.

23 Q Which Hoekstra attempted
24 to do?

25 A Exactly.

26 Well Hoekstra has done a great
27 deal of theoretical work. The paper which I have
28 referred to is an empirical paper, experimental.

29 Q Now page 13, the second
30 line from the bottom, the penultimate line, you say,

1 in the middle of the sentence, "...significant heave
2 will occur". Have you tables or studies that quantify
3 that heave?

4 A Well I don't know about
5 tables, but one does calculations, based on the rates
6 which the water moves under the gradient, and now I am
7 talking about the pulling force gradient that one
8 believes, or knows to exist. When I say believes on
9 those, one understands the fundamentals but it's the
10 particular condition of a given point in the pipe, you
11 see, that always remains uncertain because we don't
12 know exactly what soil you would have.

13 Q Well I believe elsewhere
14 in the paper you say that shut-off pressures of four
15 or five times the ones proposed by Northern Engineering
16 are going to be required, and I was wondering if you
17 have prepared studies which we could refer to, which
18 set this out?

19 A Yes, well I chose four
20 or five, I could have said ten or twenty or more even.
21 I chose four or five because in my own experiments, I
22 measured some four atmospheres pulling force, and so
23 to stop the water being pulled into that sample, I would
24 have had to apply four atmospheres. Four atmospheres
25 is about 8,000 psf, I think, that order of things.

26 In other words, it is about
27 four times what Northern Engineering Services have
28 suggested as being their average upper maximum value,
29 I believe, was 2,000 to 3,000.

30 Q 3,000, in that order.

1 A Yes, well 3,000, that's
2 one and a half atmospheres.

3 Q I'm sure Mr. Marshall will
4 be addressing you on that.

5 A But to stop Hoekstra's
6 ice lens growing, you see, he would have had to reply to
7 minus -- when the ice lens was at a temperature of minus
8 6, he would have had to applied a huge shut-off pressure
9 to stop that thing growing. It was 800 pounds per square
10 inch. It was the heaving pressure.

11 Q But on the basis of a
12 considerably steeper temperature gradient than you're
13 conceding exists in nature?

14 A Yes, but the temperature
15 gradient there was not the cause of the heaving pressure,
16 having that high value. It was necessary for the
17 experiment to have a high temperature gradient. That
18 was the clever part about the experiment, to get it to
19 work, 'otherwise you would have to wait a long time,
20 and have problems.

21 Q Well this is something,
22 no doubt that we will come back to in time, but for the
23 moment I will leave it.

24 Now, on page 2 of the second
25 part of your evidence in chief, you refer almost half-
26 way down, you say, "Yet the ~~peave~~ must to meet the guide-
27 lines, be prevented".

28 Which guidelines are you
29 referring to?

30 A Well the fact that there

1 was two and a half feet in a hundred feet deflection,
2 and that's the same as three inches in 10 feet, as I
3 understand it.

4 Q I see. I wasn't sure what
5 that word referred back to.

6 Now on page 7, you speak of
7 the problems with respect to river crossings. In making
8 the statement, I just wonder if you are aware that the
9 proposed depth of burial by either Arctic Gas or Foot-
10 hills is substantially greater than it would be on the
11 ground, where it's not at a river crossing?

12 A You mean the distance
13 below the river bed --

14 Q That's correct.

15 A -- was to be greater?

16 Q Yes.

17 A No, I can't say that I
18 had --

19 Q In the order of 25 to 30
20 feet, as a matter of fact.

21 A Yes.

22 Q Were you aware of that?

23 A No.

24 Q I'm sorry to be skipping
25 around a bit here. On page 9 of your question and
26 answer sequence, the first question is -- deals with
27 the heaving of ground above the pipe. Now, you're
28 dealing with frost that develops in the ground above
29 the pipe, as I understand it, and heaves up that ground.
30 In other words, you can leave the pipe out of it for

1 now.

2 A Well I presume that was
3 what the question referred to.

4 Q Yes.

5 A Yes.

6 Q And is it not a fact that
7 heat will penetrate down into this ground during the
8 summer season and therefore collapse the ground which
9 has built up, so that it reverts to its former position?

10 A Well that depends on where
11 you are in the pipe. If you go rather far north, the
12 active layer, as we call it, the layer which is frozen
13 and thawed every year is rather shallow, and added to
14 the fact that you have got a cold pipe down there, it
15 would be made even more shallow because you have got a
16 cooling effect from below, then not all of it necessarily
17 would be, but the top part presumably would be.

18 Q Well isn't it a fact that
19 the freezing front will be at a certain level and then
20 move up as the temperatures get colder, the ambient
21 temperatures in the air, and this will cause the frost
22 heave, and then the freezing front will then revert
23 back to essentially the same position it was in the
24 summer before?

25 A No, it's not quite like
26 that. It isn't that the frost front so much rises up
27 again as it comes down from the surface when the winter
28 comes on. There will be a slight tendency for it to go
29 up away from the pipe, as you were saying, but it comes
30 from the surface downwards because the --

1 Q I think we are just going
2 at it from a different way here.

3 A Yes.

4 Q In the summer you have got
5 the frost front below the surface of the ground?

6 A Well that would depend,
7 I suppose, where you are in the length of the pipe.
8 The furthest north situations, I don't know, but where
9 the pipe -- what are the temperatures one's talking
10 about, 15 degrees Fahrenheit?

11 Q Well if I were to tell you
12 that there's an active layer all the way up to the
13 northern end of the proposed pipeline, would you be in
14 a position to disagree with me?

15 A I'm just saying that I can
16 conceive of a situation where there is no active layer,
17 at the far north position, particularly if you have got
18 some --

19 Q Do you know of any situat-
20 ion where this exists at the northern end of the pipe-
21 line?

22 A Well I don't know of any
23 pipeline yet.

24 Q Or are you suggesting it
25 will come after the pipeline goes in?

26 A Oh yes, yes, yes.

27 Q All right. On Page 2 of
28 your question and answer sequence --

29 A Excuse me, I hope I made
30 myself clear. I was answering the question, after the

1 pipeline is built, is there a possibility of there being
2 no active layer at the far north.

3 Q Yes.

4 A I am saying the possibility
5 is there.

6 Q Yes.

7 A That's all I wanted to
8 say.

9 Q But you have no proof of
10 it, that's --

11 A Because there's no pipeline
12 yet.

13 Q That's right, but you know
14 of no experiments that have gone to show that there might
15 or might not be an active layer, that's what I'm refer-
16 ring to?

17 A Well I think one could
18 make some calculations. I would guess you would find
19 the odd place where there would be no active layer, but
20 it would be a place where it was covered with some
21 insulating vegetation, something like that.

22 Q But you have no papers or
23 studies that show that?

24 A Well now because the
25 situation --

26 Q Even on a theoretical
27 basis?

28 A Well I think theoretically
29 I would want to use pencil and paper a little bit, but
30 I wouldn't think it's even possible.

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1 Q But there's no paper now
2 that shows it on a theoretical basis, that you know of?

3 A Well people don't discuss
4 these certain things, hypothetical situations of a cold
5 source in the ground, except in connection with the
6 pipeline. This is why we are discussing it now.

7 Q I understood scientists
8 discussed hypotheticals all the time but I won't go into
9 that.

10 On page 2 of your question and
11 answer sequence, you make the statement, "Now there
12 will be no heave where the pipe lies on the rock", in
13 other words the rock doesn't heave from frost. Is that
14 what the statement says?

15 A Yes, rock doesn't -- if
16 we are talking about really hard rock, granites, and so
17 on, I don't think they expand significantly.

18 Q But you're concerned that
19 there will be heave of the fine silty material that's
20 next to the rock that will push up the ground there and
21 consequently push up the pipe?

22 A M'hmm.

23 Q Well isn't there a certain
24 rigidity to the pipe?

25 A Well this is not an aspect
26 which I'm particularly knowledgeable about, and insofar
27 as the developed heaving pressures are concerned, then
28 that's not a matter of the pipe. It's the ground
29 developing the heaving pressure, and with regard to the
30 magnitude of heave that may develop, that again, if you

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1 understand me, I am talking from the point of view of
2 the ground. I don't know what rigidity the pipe may
3 have.

4 Q I may be quite in error
5 here, but I would understand you to be saying in that
6 answer, that the pipe will actually bend at the point
7 where the pipe goes from rock into silt, and that's
8 where you will get the deflection that you say is not
9 permissible. Am I misinterpreting your statement there?

10 A Well I haven't said the
11 pipe will bend, because I don't know what the rigidity
12 of the pipe is, but what I am saying is that we would
13 expect frost heave at this junction, differential heave,
14 and I have explained the length that the pressures asso-
15 ciated with this heaving are very large. If the rigidity
16 of the pipe exceeds those pressures, then obviously
17 the pipe won't bend.

18 Q So the pipe in fact over
19 the rock will lift up as well, so that you will get a
20 smoother curve of the type that you say won't happen?

21 A Well I'm afraid I don't
22 know about the behaviour of pipes, I am not a metallur-
23 gist, and I'm merely pointing out that there is a
24 differential heave process, the rock can't heave, the
25 soil can heave and can exert pressures of the magnitude
26 that I talked about.

27 Q So if your pipe was
28 purely flexible, then you would get that lift of three
29 inches in ten feet that you're concerned about?

30 A Oh yes, yes.

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1 Q But being a rigid steel
2 pipe you're not in a position to say because you haven't
3 done any studies on pipe? Is that what I understand
4 your answer to be? You don't know about pipes?

5 A No.

6 Q Okay. Now lastly on
7 page 11 of your question and answer sequence, -- sorry
8 that starts on page 10, your answer.

9 THE COMMISSIONER: You are
10 going on the basis of the heave that Northern Engineering
11 allowed for? In looking at that and saying that the
12 heave you think may well be very much greater, without
13 worrying about the strength, rigidity or flexibility of
14 the pipe itself, which is their problem in a sense, not
15 yours. Is that --

16 A Well Northern Engineering,
17 as I understand it, have said that they can maintain
18 the three inches in the ten feet, two and a half in a
19 hundred foot, and part of their -- or their reasoning
20 is based on the exerted pressures by the ground, and I'm
21 saying the exerted pressures are greater than they have
22 said, and therefore I don't know whether the pipe will
23 be able to resist --

24 THE COMMISSIONER: Precisely,
25 yes. That pipe was designed to accommodate the heave
26 that you referred to three inches in ten feet, or what-
27 ever it was. What you are saying to me is that without
28 knowing anything about the strength of the pipe, the
29 heave may very well be much greater, so if the pipe
30 wasn't built to accommodate that much larger heave,
difficulties may occur?

1 A Much like a heaving-
2 pressure of that sort.

MR. HOLLINGWORTH:

3 Q Yes. Well in your
4 answer that begins on page 10, Dr Williams, do you
5 say that it's logical to have a cold pipeline where
6 permafrost is essentially continuous, but that after
7 you get out of this area, that it would be more
8 sensible to revert to a warm gas pipeline, do I inter-
9 pret you correctly?

10 A Well actually I struck
11 out of the sentence that you just read.

12 Q All right maybe I had
13 difficulty reading it.

14 Do you in fact agree with that
15 principle?

16 A Well you're asking me
17 if the sentence I struck out I still believe in?

18 Q Alright, let's go at
19 it this way. Do you think it's sensible to revert from
20 a chilled gas system to a warm gas system or an unchilled
21 gas system after you get out of an area that is
22 essentially continual permafrost?

23 A Yes.

24 Q So in that sense, you
25 would agree --

26 A After at the junction,
27 when you leave continuous permafrost.

28 Q Right, and in that
29 sense, I take it you agree more with the approach,
30 suggested by Foothills Pipe Lines than that suggested

1 by Arctic Gas, in that the Foothills proposal would
2 cease chilling much further north.

3 A Well in that sense it's
4 better, the Foothills proposal.

5 Q I'm talking in general
6 terms, I'm not trying to get you --

7 A As far as the changeover
8 were further north, then it's better.

9 MR. MARSHALL: I thought
10 we were told they didn't know where that point was sir,
11 just so the record is clear.

12 MR. HOLLINGWORTH: It's further
13 north than you, Mr. Marshall we do know that.

14 I have no further questions.

15 THE COMMISSIONER: Well I've
16 got a note of that, Foothills is better.

17 I think it's coffee break time,
18 we'll let you carry on after that.

19 (PROCEEDINGS ADJOURNED)
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(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

THE COMMISSIONER: We will come to order, ladies and gentlemen.

MR. GOUDGE: Mr. Bayly is on the telephone, I understand.

THE COMMISSIONER: Well, we will carry on, he can read the transcript.

CROSS-EXAMINATION BY MR. MARSHALL:

Q Dr. Williams, I appreciate that we went through your short C.V. and we may not have covered all of your background and so on, and one point I was interested in was whether or not you are a professional engineer?

A No, I'm not a professional engineer, but I have spent all my professional career, I would say, working closely with engineers, in the Norwegian Geotechnical Institute and the National Research Council.

Q Your emphasis has been really on the theoretical aspects of it?

A Well, to be as explicit as possible, the various work that I have been engaged in, has been done in cooperation with and sometimes at the behest of the engineers in these institutions.

Q I take it, sir that in the preparation for your testimony, you would have

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1 familiarized yourself with all of the Arctic Gas frost
2 heave work, and that specifically would include the
3 testimony that the geotechnical panel gave at these
4 proceedings?

5 A Well I have certainly gone
6 through a lot of testimony and reports and so on, and I
7 should say it was several months ago now.

8 Q But you have specifically
9 gone through the testimony and the cross-examination of
10 the geotechnical panel before this Inquiry?

11 A Yes, yes, I think so. I
12 think I have seen the whole lot.

13 Q And you would, as well,
14 have had a look, would you sir, at the responses that
15 Arctic Gas submitted to the Pipeline Application Assess-
16 ment Group, and I think the two that are of particular
17 relevance are your responses number 20 and number 56.
18 Do you know whether you have had a chance to look at
19 those?

20 A Well, could you tell me
21 what they refer to?

22 Q Number 20 pertained to
23 terrain stability, southern permafrost region, and the
24 other was 56, and that pertained to pipeline stability
25 following inactivation or abandonment.

26 A Would it be possible to
27 just look at them? I don't want to read it all but just
28 to see if it is familiar.

29 THE COMMISSIONER: Here's
30 another copy.

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1 MR. MARSHALL: I don't think I
2 will need it, sir. It's just a matter of whether or not
3 the witness is familiar with the material.

4 A The first one looks
5 familiar. The second one, I'm not sure that I have seen
6 the second one. It may be that the pipeline group did
7 some deleting and so on to produce the volume of stuff
8 I was being sent to look at, you know.

9 Q I see. Your impressions
10 is then, that you wouldn't have seen that particular
11 response?

12 A Well I have certainly heard
13 of the problem of the question of inactivation, and it's
14 just that it doesn't --

15 Q The reason I am raising
16 this, sir, is that it's I think of considerable import-
17 ance to know whether or not you, in reaching your con-
18 clusions, are looking at all of the data that's been
19 available to the engineers who have been doing the
20 frost heave work for Arctic Gas?

21 A Well I had been asked
22 particularly to look at the question of the generated
23 pressures and the possibility of overcoming them with
24 applied shut-off pressures. In that connection, I saw
25 two great, thick volumes of laboratory and field tests,
26 Calgary, and so on, and of course a series of questions
27 and answers. My colleagues were engaged, too, at
28 Carleton, so across my desk also went large amounts of
29 literature about things like river crossings and
30 geothermal analyses and so on. And I looked at these

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1 and my colleagues' comments on these, but I didn't myself
2 actually do the analyses of those.

3 Q Well to get right down to
4 the question though that was asked, you are not able to
5 say today whether or not you are familiar with response
6 number 56 to the Assessment group's question ?

7 A Well that's this one here
8 and I don't recognize that

9 Q Fine, that's all I was
10 interested in. Number 20 I think you have gone over.

11 A Yes.

12 Q Now, you mentioned that
13 you have looked at the testimony.

14 The other thing that I was
15 interested in, sir, was the reports that have been done,
16 The Frost Effect Study of Northern Engineering of May,
17 1974 and Results From Frost Effects study of Northern
18 Engineering, March, 1975.

19 A Yes.

20 Q You had both of those?

21 A Yes.

22 Q Sir, in your presentation
23 you made use of a slide taken from Hoekstra. Is it
24 correct that Hoekstra's experiment was designed to con-
25 sider physical phenomena other than heaving?

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1 A Well I don't know
2 what you mean by that exactly. What does he say
3 he is studying water movements and freezing pressures,
4 well the freezing pressures was the main point.
5 And it was the pressures as the abstract made quite
6 clear, that it was the pressures.

7 Q Well I'm quoting from the
8 first page, that's page 512 of the article which is
9 taken from a journal and he says, "If radically
10 different experimental conditions are imposed on a soil
11 system, physical phenomena other than heaving become
12 important." I was just wondering whether or not you
13 agreed that his experiment was designed to consider
14 physical phenomena other than heaving?

15 A Well he was studying
16 pressures anyway, not heaving per se, the heaving
17 pressure is what he is concerned with. But this
18 particular paragraph "If radically different experimental
19 conditions are imposed on a soil system physical
20 phenomena other than heaving become important." I
21 really don't know what he's driving at. And then he
22 goes on to say that "Under constant volumes, the system
23 is prevented from heaving" well that's obvious isn't
24 it.

25 Q And that's the sort of
26 system he was dealing with?

27 A Yes. He's saying because
28 the volume is constant, if it's constant, then
29 obviously it can't heave because heaving is an increase
30 in volume.

1 Q Well let's get back to
2 the question. Is it correct that his experiment was
3 designed to consider physical phenomena other than
4 heaving or do you have no opinion about that?

5 A I don't think it was
6 designed to consider phenomena other than heaving,
7 to the exclusion of heaving. I mean the main thing
8 was the pressures and they are the heaving pressures,
9 That's what he was concerned with.

10 Q That's your understanding
11 of it?

12 A That's what he said in
13 the abstract.

14 Q Well I understand sir
15 that the heaving rate in Hoekstra's experiment was
16 zero, and he was dealing simply with a re-distribution
17 of moisture within the soil sample.

18 A Yes, well, you see he was
19 getting a maximum pressure and of course the maximum
20 pressure is that at which the heaving just ceases, but
21 in his experiment, there was expansions going on, but
22 the way it was done, was to measure the pressure developed,
23 now the maximum pressure here is the shut off pressure.

24 Q But there was no
25 expansion/ and there was no heave.

26 A Well one would hope not.
27 That's the definition of the maximum pressure.

28 Q That's simply the point
29 sir.

30 Sir, at page 13 of the text. and

1 it was not the questions and answers but the first
2 page 13 if you like. in your direct presentation, you
3 make the statement, "however the information I have seen
4 does not convince me that they succeeded in totally
5 stopping the heave in a number of cases."

6 Sir. what I was interested in
7 was this, whether or not the -- we're talking about
8 heave associated with in situ water which was not
9 stopped, is that what you were referring to?

10 A No, not exclusively.

11 Q Was that one of the components
12 of the heave?

13 A of the heave that I am
14 saying was continuing--I would suppose so.

15 Q Well that's a pretty
16 important consideration isn't it?

17 What are you saying was not
18 stopped, the heave associated with what?

19 A Well, in the experiments
20 described in these volumes, the procedure was to
21 apply pressure that stopped water moving into the soil
22 and measure those pressures.

23 Q Right.

24 A Now what happened to water
25 inside the soil, as I understand it, wasn't really
26 considered and you're asking me whether when I say that
27 in fact I don't think that water would even stop moving
28 into the soil, if you went on long enough, well
29 obviously it didn't purport to stop the heaving due
30 to the in situ water.

1 Q With respect to the in
2 situ water, and that's the nine percent expansion, as
3 I understand it, that you get when you freeze water.

4 A Um-hmm.

5 Q My information is that any
6 N.E.S. has, in their work separately take this into
7 account. Are you aware of that?

8 They considered it as separate
9 from the lensing and included the factors.

10 A It depends in what
11 context the statement is made, that it was taken into
12 account.

13 Q In predicting the heave

14 A In predicting heave?

15 Q Yes, as I understand it,
16 they have taken a conservative approach with this and
17 have assumed that there will be freezing of all of the
18 in situ water, which may or may not ---

19 A Yes, they may have said
20 that but insofar as I'm saying, where the maximum
21 heaving pressures are greater than they say then it
22 follows that the statement is not really relevant.

23 Q I still don't know
24 whether I've got the picture sir. Getting back to your
25 statement here, "However the information I have seen
26 does not convince me that they succeeded in totally
27 stopping the heave in a number of cases. Are you able
28 to tell me which aspect of the heave was not stopped.

29 A Yes, I tried to explain
30 what first made me think that, and I must say that it's

1 two months at least since I saw the volume, because I've
2 been away and didn't take it with me. There are graphs
3 showing the rate of frost penetration, on the same
4 page, in fact line one above the other, has graphs
5 showing -- it's either the heave or the rate of water
6 intake. And one is shown with a square root time scale
7 time is put on a -- you take the square root of time
8 but the other graph with which we're supposed to compare
9 it, is on an arithmetic time scale. I wonder if it's
10 possible to find the relevant one.

11 The advance of the freezing
12 front is shown in the graph in which the time scale
13 is the square root of the time, and underneath it is
14 the graph showing the change in pore water volume, again
15 as a function of time but the time scale is arithmetic
16 which means that 1,000 minutes is exactly half of the
17 length given to 2,000 and so on and we are in effect
18 asked to compare these and you see, the change in the
19 pore water volume, and I might say it is increasing
20 because it is taking in water, and there's no misunder-
21 standing about that, but it appears the rate of taking
22 in the water is decreasing, which is fine, indeed it
23 probably is. The rate of taking in water. The advance of
24 the freezing front is shown however on a square root
25 time scale, and that also appears to be decreasing, which
26 we would probably expect too. But if you put the square
27 -- if you put the change in the pore water volume
28 plotted ^{it} with a square root time scale, then the slope
29 would change and would suggest that the water is being
30 taken on at -- in effect, a relatively greater rate than

1 that at which the frost line is advancing.

2 I think I've got this interpretation correct. I
3 discussed it at length with several people and it's
4 fairly important.

5 Q I have difficulty with
6 understanding how you can be convinced that the -- you
7 have not been convinced that they have succeeded in
8 totally stopping the heave, and what that's attributed
9 to, in your judgment.

10 A Oh well, I mean I think
11 they don't pretend they've totally stopped the heave
12 in that figure at all because the water is still going
13 in.

14 It's going in slower and
15 slower, however and nobody would argue about that. But
16 the frost line is penetrating slower and slower too.
17 So for every little increment of extra frost depth,
18 you compare it with the increment of water that was
19 added in that time and that's when you find something
20 rather remarkable, that the amount of water going in,
21 is decreasing but it's not decreasing as fast as the
22 rate of penetration of frost is. So the net result is
23 that every little increment has got a bit more extra
24 water in it as time goes on. This is just a scientific
25 point. I don't quite know why it was plotted with the
26 temperature, frost penetration on a square root of time
27 basis. It's perhaps a convention we have but I think
28 it was perhaps unfortunate and they should have been
29 on arithmetic scales or both on square root scales.

30 Q I was wondering sir if

1 you knew of any other way to predict heave, different
2 from that that's been proposed by the advisors to
3 Arctic Gas?

4 A Would you say that
5 again?

6 Q Do you know of any other
7 way to predict frost heave, a way different from that
8 proposed by the advisors to Arctic Gas?

9 A Well there's a variety
10 of ways that are used both in practice and have been
11 suggested experimentally. Of course, the highway
12 engineers habitually measure the grain size composition
13 of the soil, ^{it is} a method that is not really defensible
14 theoretically but it works roughly for the highway
15 people.

16 Q For highways. You
17 wouldn't suggest it for pipelines?

18 A Well I mean you mustn't
19 throw out these elementary approaches because in
20 practice, you often can't do anything more sophisticated
21 but it can never be an exact test the grain size
22 composition procedure. People have tried other tests,
23 based on --

24 Q Excuse me. this is really
25 frost susceptibility criteria that you're talking about
26 here, rather than frost heave?

27 A Yes I thought that's
28 what you meant?

29 Q No, I meant really
30 predicting frost heave.

1 A The actual quantitative
2 amount of heave?

3 Q Yes.

4 A Do I know an alternative
5 test?

6 Q Yes.

7 In an alternative technique.

8 A Yes there is the
9 strictly theoretical approach, in which you take a
10 number of input parameters, which you determine in-
11 dividually, they're very numerous and Dr Harlan of
12 course knows all about this and -- I mean that approach
13 is, I think, excellent.

14 Q That doesn't help me
15 very much because it just tells me it's a theoretical
16 approach involving a number of input parameters and
17 where does that take me?

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1 A I can tell you where it
2 doesn't take us. The weakness lies in the accuracy of
3 the input parameters that we have to determine.

4 Q And having something to
5 test them against?

6 A Not test them against
7 exactly, but if you have one of the input parameters,
8 the thermal conductivity of the soil, and
9 the question at once becomes how good, how good deter-
10 minations can we make of thermal conductivity of soil ?

11 Q Does that exhaust your
12 list of alternative approaches?

13 A Well I mean, I have said
14 there's a theoretical way and there's an experimental
15 way. The procedure here, of course is the experimental.

16 Q Have you --

17 A I would say exclusively
18 almost.

19 Q Sir, you mentioned a
20 theoretical approach as contrasted with an experimental
21 approach, and I was wondering whether you have in an actual
22 engineering situation employed such a theoretical
23 approach?

24 A No, I don't believe any-
25 body has attempted to provide engineering solutions
26 using a theoretical approach full out. I mean, one
27 uses engineering judgment and all that sort of thing.

28 Q So you wouldn't then be
29 able to, by reference to a specific concrete example,
30 field example I suppose, be able to tell us about

1 methodology or the exact situation. None to your know-
2 ledge exists?

3 A You mean --

4 Q --- the point being theo-
5 retical ---

6 A -- could I tell you or
7 refer you to somebody who would do it for you?

8 Q No, who has done it, sir?

9 A No, no.

10 Q Well if you were faced
11 with the challenge of predicting frost heave for a
12 chilled pipeline, which approach would you tend towards?

13 A If I was asked to predict
14 quantitatively the amount of heave for a chilled pipeline,
15 I am afraid I would decline the job.

16 Q I think that's the first
17 for any consultant who has appeared before the Inquiry,
18 sir. Most of them feel that no challenge is too great,
19 to at least consider in considerable depth.

20 Now sir, I want to turn to your
21 suggestion in your evidence that the Arctic Gas method
22 is not reasonably predicting field performance, and I
23 wanted to know, sir, what it is you base that on? Well,
24 to begin with, is that essentially your position?

25 A Well, yes, I think perhaps
26 that describes it correctly. Arctic Gas have based
27 their approach on certain measured values of maximum
28 heaving pressures that can be expected. Those heaving
29 pressures are much less than those that I believe will
30 occur, and well, therefore I questioned the procedure.

1 Q As I understand the reports,
2 they give predicted values, measures of heave, and then
3 they measure them and they give you one as contrasted
4 with the other. Do I take it that you do not accept
5 that those predictions are within a reasonable degree of
6 accuracy to what is actually being measured in the tests?

7 A Well, I mean the laboratory
8 tests were done in a short period of time and what we
9 have to do is to say what is going to happen in five,
10 ten, twenty years.

11 Q Well let's start with the
12 time period that's been available though, sir. You have
13 been able to analyze the reports and the data.

14 A Yes.

15 Q Now, would you say that
16 based on that time frame, that you're dissatisfied with
17 the correlation between the predicted values and the
18 actual measured values?

19 A The predicted values of
20 what?

21 Q Frost heave?

22 A Well I'm not sure that --

23 Q I'm dealing here with
24 the tests --

25 A At the Calgary test site,
26 for example --

27 Q Yes, right.

28 A -- well, I would perhaps
29 want to look at the correlation.

30 Q Well I would assume you

1 had, sir.

2 A Well I have indeed, but
3 it was not perfect, but whether it's reasonable and so
4 on, I think the actual amount of heave no doubt is in
5 the right order of magnitude compared with the predict-
6 ions. That wasn't really the prime question, as I see
7 it, in the problem --

8 Q Well we have got to start
9 somewhere, don't we, sir, and --

10 A Yes.

11 Q -- what I am getting at --
12 the tests results to date, given the time frame that we
13 are talking about. Now, do you take the position that
14 there has not been a reasonably accurate correlation
15 between the predicted frost heave and that measured
16 over the time period that's been available?

17 A The actual amount of frost
18 heave and the predicted, as far as I can recollect,
19 seemed reasonable, bearing in mind the nature of the
20 experiment, but --

21 Q Well, you say "bearing in
22 mind the nature of the experiment". Does that imply
23 that you have a criticism of the way in which the experi-
24 ment was set up or carried out that leads you to suspect
25 that its results may not be accurate?

26 A Well yes and no.

27 Q Let's deal with the yes
28 first.

29 A All right. The shut-off
30 pressure has been identified in the experimental work

1 in the laboratory with the pressure which was necessary
2 to prevent entry of water into the sample. It has also
3 been identified with the pressure as measured in the
4 laboratory tests, which took a day or two or a week or
5 something, and to my mind, the shut-off pressure we need
6 to know, are those which will occur or be required over
7 these much longer time spans, and secondly, the fact
8 that the water did not actually enter the sample was not
9 necessarily indicative of the achievement of the maximum
10 required shut-off pressure.

11 Q Well I think you're maybe
12 getting a little bit ahead of me, if I'm still with you
13 and there may be some doubt about that. I thought we
14 were dealing with the period that's been available, to
15 date.

16 A All right.

17 Q And whether or not you
18 have got a basic criticism with the manner in which the
19 tests have been set up and run, and so on, the method-
20 ology.

21 A Yes.

22 Q To this point. Not whether
23 or not they have some capability to do something over
24 a very long term, which I want to get to --

25 A I have a criticism of the
26 methodology.

27 Q Well perhaps you could --

28 A Yes. Well I stand to be
29 corrected on this, but as I understand it, the shut-off
30 pressures were applied, to the top I presume of the

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sample, in order to stop the entry of water into the bottom of the sample. The thing might have been the other way up, I don't know, but the idea was to apply enough pressure to stop the entry of water into the sample. But I don't think that the actual heave taking place was being measured with a great deal of accuracy at the same time.

The primary interest was whether the water stopped going in or out, or not. The fact that the water stopped going in didn't mean that the pressure being developed, and which was being counteracted, was in fact totally counteracted and the volume may have been well increasing by a very small amount.

Q Well if I understand your first criticism, if you like, the methodology is that you are not satisfied that the heave was being accurately measured. I'm instructed that it was being measured to within one-one-thousandth of an inch.

A M'hmm, well I mean, that may be. We have dial gauges that claim that sort of thing, but if I could --

Q Well now -- just let me concentrate on that point, sir. Now, are you dealing with something that you know about or something that you suspect about, or something that just is a possibility?

A Yes.

Q You have made a criticism and I'm not suggesting that you have made it without

1 giving it great thought, and I just want to know what
2 the basis of the criticism is?

3 A Yes. Well one one-thous-
4 andth of an inch sounds very impressive, and I presume
5 that the accuracy of the heave measuring system was plus
6 or minus one one-thousandth of an inch. And that was in
7 a period of a few days, I don't know how long a period
8 involved was, but to make a simple example, supposing
9 it was one day and we could in fact have been having --

10 Q Well excuse me, sir.

11 But --

12 THE COMMISSIONER: Well excuse
13 me --

14 MR. GOUDGE: Perhaps Mr. Mar-
15 shall could let the witness answer the question.

16 THE COMMISSIONER: I think Dr.
17 Williams is entitled to pursue it, and you can carry on
18 with that, but complete your thought at any rate, sir.

19 MR. MARSHALL: Fine.

20 A The gauge was capable of
21 measuring any heave that was greater than a thousandth
22 of an inch, but it wasn't capable of measuring less
23 than a thousandth of an inch. That's what we understand
24 by measuring something with an accuracy of a thousandth
25 of an inch.

26 Now, if the experiment lasted
27 one day, we could in fact have had a heave that was not
28 one one-thousandth of an inch, but point nine of one
29 one-thousandth, and we wouldn't have known anything about
30 it. We wouldn't have known anything about it. In a

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1 thousand days we would have had nearly an inch of heave
2 and you wouldn't have known about it.

3 MR. MARSHALL:

4 Q Well sir, this is the
5 difficulty I'm having. I'm trying to get at the basis
6 of your criticism, and you respond with a supposition.
7 Well if this, and if that and if this and if that,
8 and --

9 THE COMMISSIONER: Excuse me.
10 Let me see if I understand your criticism of ^{the} Calgary
11 frost heave experiments.

12 You say --

13 A Could I interrupt, Mr.
14 Commissioner? This was in reference to the laboratory
15 experiments.

16 THE COMMISSIONER: Yes, I
17 understand that.

18 A I'm sorry.

19 THE COMMISSIONER: Well yes,
20 the one inside the building, I was there once and there
21 was one outside and one inside. At any rate, don't let
22 me totally confuse things by trying to tell you what I
23 saw.

24 You are talking about the
25 purpose of their frost heave experiment. As I under-
26 stand it, you're saying that they measured -- sought to
27 measure the movement of water towards the frost front,
28 and you say that that isn't enough.

29 Now, so far I understand you.
30 Was that insufficient because there is water within the

1 -- past the border, that is within the frost front
2 itself, within the frozen ground, water in place there
3 already, that would be unfrozen, notwithstanding that
4 the temperature might be only 28 or 29 degrees, and --
5 or as low as 28 or 29 degrees, and that it itself would
6 be converted to ice if you introduced the chilled pipe-
7 line, and that that wouldn't be taken account of in
8 terms of movement of water towards the frost front?

9 A This is one of the physical
10 circumstances behind my criticism, not actually the only
11 one. I'm not sure whether the entry of water could be
12 measured with the necessary precision, either, but at
13 the present time we are referring to the measurement of
14 the actual volume expansion.

15 THE COMMISSIONER: Oh yes, I
16 understand that, but you in measuring the volume -- that
17 was your first criticism, the one I tried to delineate.

18 Your second criticism was that
19 the measurement itself of the frost heave would not be
20 complete because of the fact that there would be this
21 one ten-thousandth -- or one one-thousandth of an inch
22 of heave that would be unaccounted for?

23 A Exactly.

24 MR. MARSHALL: Sir, if I can
25 just go back on that first point about the in situ
26 water.

27 Q The point I was trying to
28 make with the witness was that to ask him whether or not
29 he had been aware that N.E.S. have treated this as a
30 separate element, and they have calculated the heave

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1 that would be associated with the freezing of in situ
2 water, and they have treated this as a separate aspect
3 of the total heave picture, if you like, and they have
4 taken a conservative approach in that they assume that
5 all of the in situ water would freeze and would expand
6 by this 10 percent factor.

7 THE COMMISSIONER: Well you
8 asked Dr. Williams a while ago whether he was aware of
9 that and he said it would depend on the context in which
10 they carried out this separate investigation, or some-
11 thing like that.

1 MR. MARSHALL: I think the
2 point was left.

3 THE COMMISSIONER: Yes.

4 MR. MARSHALL: There was some
5 uncertainty about it.

6 THE COMMISSIONER: Forgive me
7 for interrupting.

8 MR. MARSHALL: That's fine
9 sir.

10 Q Well then we're getting
11 back to the measurement of the frost heave as I
12 understand, in your critique if you like, of the metho-
13 dology employed, you focus on the measurement of the
14 frost heave and I suggested that the measurements
15 were taken to one and a thousandth of an inch and you're
16 telling me that if we have very very little frost
17 heave, that an instrument that can only measure to one
18 one thousandth is of no value, it doesn't really tell
19 us anything. But surely sir, here we're not dealing
20 with values in that range, we're dealing with much
21 more significant amounts of heave, and an instrument
22 that's calibrated to that level of fineness is going
23 to be able to tell us something.

24 A I don't agree. I mean,
25 if you can be overlooking, a heave or a thousandth of
26 an inch, per inch, I take it, actually you have a slightly
27 bigger specimen which is more favourable.

28 THE COMMISSIONER:
29 Q You said that if you had a
30 pipeline, that would be as much as an inch in three
years, that would not be taken into account.

1 A It would be worse still
2 in the real case of the pipeline. In the laboratory
3 experiment alone, if you're failing to measure a
4 thousandth of an inch, every day, to make it easier,
5 I mean if it's seven days it makes it more complicated,
6 but you're failing to measure a thousandth of an inch
7 every day so that's an inch in a thousand days.

8 Q Well we could around and
9 around I suppose in the methodological aspect of it,
10 sir, and I don't pretend really to understand it, but
11 my simple minded approach to it tells me that if you're
12 dealing with a longer time period than one day, whether
13 you've been able to measure amounts of less than one
14 one thousandth of an inch in a particular day, it may
15 not be that significant, you have a much longer time
16 period in which to examine the phenomena.

17 A Well I don't think so.
18 I mean I said that I took a day to make it easy, but
19 you're saying well actually the error was a thousandth
20 of an inch over a longer period of time, maybe a week
21 or two weeks or something. I might say the error gets
22 a little longer with time because other things tend to
23 change in laboratory work, room temperature and this
24 sort of thing. Nevertheless the point is just as valid.
25 I mean it's true if the period was ten days rather than
26 one day, you have an error of a thousandth every ten
27 days, then it would appear to take ten thousand days
28 which is much longer. I want to emphasize that that
29 was just over a five inch column of soil and so the thing
30 is multiplied under the pipeline which is a 30 foot

1 column of soil.

THE COMMISSIONER:

2 Well we can perhaps

3 leave this to rebuttal sir, it's a very technical point.

THE COMMISSIONER: '

4 There is one thing you've raised, twice now. You say
5 that Arctic Gas or Northern Engineering Services dealt
6 with this whole question of what about the water in
7 situ within the frozen ground that hasn't frozen.
8 Notwithstanding the temperature of the ground. being
9 below freezing. Well you say that Arctic Gas, Northern
10 Engineering Services took that into account in some
11 separate, fashion that I don't think ^{made} has been / clear to
12 Dr. Williams, what -- shouldn't you put that to him
13 before just leaving the matter for rebuttal. He s
14 going back to England presumably and we won't see him
15 again, I shouldn't think.

16 MR. MARSHALL: I didn't

17 realize we had a disagreement on that point. I had
18 understood that he wasn't certain how it had been ~~treated~~
19 but perhaps I'm wrong.

20 A I would appreciate being
21 reminded of exactly how it was taken into account.

22 THE COMMISSIONER: You could
23 have Dr. Slusarchuk explain this. he's been sworn and
24 he's a witness.

25 MR. MARSHALL: That would be
26 easiest.

27 DR. SLUSARCHUCK: We are
28 interested in predicting the heave of the pipe, of
29 course and in our lab experiment, we're measuring the
30 water that is sucked in to the sample during our experi-

1 ment and that is what we have called the lensing heave
2 rate or the extra heave that you'd get in the soil
3 because you've drawn water in to the sample, where it
4 wasn't previously. We used that to calculate the
5 lensing heave rate. Now when you freeze down through the
6 soil, you've got say 20 percent water content in the
7 soil along the route, and we know how far our frost
8 front is going to be. to use a number that you used,
9 say 30 feet, we simply take into account all of the
10 water in that 30 foot zone and let it expand. And we
11 get heave from the expanding of the in situ water.
12 We then -- so that's one part of the heave, that's
13 going to happen to the pipe. We also account for any
14 lensing heave that is happening while the frost bulb
15 is advancing down to that depth, by having water sucked
16 into it. So we have in fact -- we, in fact, deal with it
17 in two separate items. We don't consider the unfrozen
18 water content of the soil, which would then reduce the
19 amount of heave due to in situ water, reducing the amount
20 that we would predict. We take a conservative estimate
21 and just assume that it's all going to freeze there and
22 from that point, it gives us the maximum amount of heave
23 that we get from that component.

24 A Yes, exactly, what is the
25 heave you calculate due to the in situ water, what are
26 the figures or the magnitude?

27 DR. SLUSARCHUK:
For 30 feet, assuming
28 natural kinds of water content, you'd get a 9 or 10
29 percent expansion of the water and there's about 30
30 percent of the soil that is filled with water, so you'd

1 get about one percent, expansion of the depth so you'd
2 get about a foot.

3 A Exactly. And that's
4 one foot and you're talking about a possible transition
5 between rock, presumably with nothing and a place with
6 a foot beside it.

7 MR. MARSHALL:

8 Q Well sir, that's a point
9 I want to get into with the witness a little later
10 and that is differential heave.

11 Unless you wanted the subject
12 exhausted now.

13 THE COMMISSIONER: I don't
14 want to exhaust it now, I just want to understand the
15 last answer. You said exactly and you said that where
16 you have a transition from rock to silty soil or
17 something that is susceptible to frost heave, that inch
18 could be very significant. Could you just repeat that
19 statement.

20 A Yes, well I didn't say an
21 inch, a foot.

22 Q A foot I mean.

23 A Well I think at the
24 place where the pipe is resting on rock and beside the
25 soil comes up a foot, then I don't see that there isn't
26 a problem. There is a problem, there is differential
27 heave of a foot. But why I jumped at the figure of a
28 foot, I had forgotten exactly how you'd done this. and
29 I did a calculation myself on how much the heave due
30 to the contained water was, and I did a calculation
differential and the figure I arrived at was one foot,

1 exactly the same.

2 MR. MARSHALL: Well sir I
3 think things have gone off the track in the sense that
4 the subject was changed. If we're talking about what
5 goes towards making up total frost heave, and there are
6 different factors that go into that, the approach that
7 Northern Engineering has taken is, that they isolate the
8 different elements, and one of those elements is the
9 heave that is associated with the freezing of in situ
10 water. Now to use the example that Dr. Slusarchuk
11 has given, and that Dr. Williams says he has done a
12 calculation and arrived at the same thing. I gather,
13 it's just -- we know if we put water into an ice cube
14 tray it's going to expand when it freezes 9 percent,
15 it's that sort of thing. Then the amount of heave
16 you're going to get associated with that in situ water
17 is a function of how much water is contained within
18 the soil at any particular place. Now, it's that
19 layer of the total heave, if you like. that Dr. Slusar-
20 chuk is talking about, and he says they consider that
21 separately. That's perhaps one of the easiest elements
22 of the total frost heave picture to calculate. Now they
23 say that's one foot in the example given. Now we may
24 be talking about total heave of several feet. Now that's
25 an entirely different subject from differential heave
26 within say a one foot area or a ten foot area which is a
27 subject I want to get to the witness with in a minute.
28 I'll try to point out and I think Mr. Hollingworth has,
29 involves the entire question of pipe soil interaction
30 and the rigidity of the pipe. So it's not really

1 necessary to get into that sort of a discussion in
2 dealing with this problem of the freezing of in situ
3 water and the heave that is associated with it. All we're
4 trying to do is say what are the components of the total
5 heave you get? Dr. Slusarchuk is saying we isolate
6 this one component and to use an example, a typical
7 case for example, it may amount to one foot and we
8 build that into our overall prediction. It's that
9 simple.

10 THE COMMISSIONER: Your
11 estimation certainly was one I could follow. It
12 must have been very, very simple. Dr. Williams, you've
13 heard what Mr. Marshall has said. Do you have any
14 comment on that so we're not at sixes and sevens here.

15 A Well if I understood it
16 right, he almost said and implied that with the foot or
17 so that we're agreed about, but because it would be
18 uniform, it wouldn't be a matter of concern.

19 MR. MARSHALL: We're not
20 talking about differential heave and we will get into
21 that later on. I'm sure that Dr. Williams will agree
22 that if we're talking about uniform heave over an
23 entire length of the line and he doesn't have a problem
24 and we don't have a problem.

25 A Except you don't get
26 uniform heave, that's the whole point.

27 Q That's a subject that
28 I'd like to get into in some depth with you a little
29 later on. I think Mr. Hollingworth has already touched
30 on it and there are many other parameters we think that

1 have to be brought into the discussion. I think we're not
2 at odds on this point sir.

3 THE COMMISSIONER: You're
4 saying that you're discussing applies and Dr. Williams
5 is discussing oranges. The one foot that Dr. Slusarchuk
6 produced was an element that went into the calculation
7 of total heaving, and had nothing to do with differential
8 heave, whereas Dr. Williams said yes there is the one
9 foot, and if you get a one foot differential heave, you'll
10 have all kinds of problems.

11 MR. MARSHALL:

12 Q Well that's the question,
13 are we going to get one foot differential heave and
14 what's that going to mean to the pipe. I think that's
15 a separate issue. There's no question in the minds of
16 NES as I understand it, that they were going to encounter
17 situations of one foot heave. And we're simply talking
18 about the various components that go up towards making
19 up total heave if you like and this is one of the aspects
20 and there's no -- the question of whether or not that's
21 going to have an effect on the integrity of the pipe
22 is this whole issue of the pipe soil interaction and
23 the rigidity of the pipe and so on.

MR. MARSHALL:

Well sir, we were at the point, and I'm sorry to belabour this, but I want to nail it down if I can one way or the other, because obviously Northern Engineering and Arctic Gas are concerned about some of these matters that have been raised in your evidence, and we were at the point of dealing with the experimental work that had been done by Northern Engineering and you were criticizing the methodology. One of the points that you were focusing on was the accuracy of the measurements of frost heave.

Now, aside altogether from the question of the point 001 of a heave and whether or not the instruments are calibrated with such accuracy as to pick this up and so on, what I am interested in is just a more general question, and that is really whether or not you know there is a problem with the measurements, that is, do you know the measurements that have been recorded by N.E.S. are inaccurate, or is this just a possibility that you're suggesting may have been the case?

Specifically, I want to know what information you have?

A No scientific measurement has an absolute accuracy. When we measure temperature, it's always accurate to something or other. Now, I don't suggest that N.E.S. have claimed a thousandth of an inch when in reality they weren't that good. They may well have dial gauges that good, but they have only

1 claimed a thousandth of an inch and that's fine. Now
2 I am not criticizing them on a sort of scientific
3 ethical basis, but I'm just saying you couldn't measure,
4 and you're saying you couldn't, less than a thousandth
5 of an inch.

6 Q Well I guess I am led to
7 the point of saying really "So what". Are you led to
8 conclude then that the results measured are not accurate?

9 A They are not accurate to
10 the required degree of accuracy. They are not inaccurate
11 in the sense that the man who read the gauge needed
12 another pair of glasses or something like that. There
13 was no error, they stated that the gauge worked to a
14 thousandth of an inch, and that's not good enough, in my
15 view.

16 Q Well what would have been
17 good enough in your view?

18 A You can't do it with tech-
19 nology as I see it, you can't tell us whether -- well
20 you simply cannot measure with the required degree of
21 accuracy without a quite different approach, except by
22 waiting 30 years, when the cumulative effect will be
23 big enough to measure.

24 Q Well now --

25 A Or waiting maybe several
26 years, not even 30.

27 Q Well sir, we are not talk-
28 ing about quantities as fine as a hair, if you like.
29 We are talking about something, frost heave, that is
30 going to be in observable measure, if you like, and you

1 have -- with a pipeline, indeed in the examples you
2 cited in highway situations and so on, you can see it
3 with your eyeball, you don't even have to have a measur-
4 ing instrument to know that there has been heave, but
5 there has not been heave.

6 A No, I'm sorry, I can't
7 agree. With the experiment that N.E.S. did, it was in
8 fact necessary to measure with an accuracy something
9 like the thickness of a hair. If you were to predict
10 what would happen cumulatively over 20, 30 years.

11 Q Well that's what I'm trying
12 to pin you down on, sir. I say we've been using this
13 measurement to one and one-thousandth, and you say that
14 wouldn't be sufficiently accurate to enable to give you
15 results that you could -- that would be useful and
16 sufficiently accurate for your purposes.

17 What degree of accuracy would
18 have been required, in your opinion, before the results
19 would be meaningful?

20 A Well I suppose one way of
21 approaching this is to say they are only interested in
22 50 years, for example. After that we'll agree that the
23 pipeline ought to be switched off or disposed of if it's
24 going wrong, so in 50 years you mustn't have a heave of
25 more than a certain figure, so you divide that figure by
26 30 years and you find out what kind of expansion is
27 going to take place every day or week, say. In other
28 words, the time period over which you can measure the
29 change of volume.

30 Q I'm sorry, sir, but maybe

ed
1 it's a lawyer's simplemind/approach to these things, but I
2 still don't understand what degree of accuracy would
3 the instrumentation had to have had in this particular
4 case, in this particular experiment, in order to produce
5 results that in your view could be used?

6 A Well it depends what kind
7 of differential heave you can accept, and we haven't
8 decided that, but supposing you could accept three
9 inches, then you say in 50 years I mustn't have more
10 than three inches, which is spread out over a 30 foot
11 column. So you divide the three inches by 50 years, and
12 find out how much per day, or per week, depending how
13 long you want to spend measuring it. Then you have to
14 say, well I'm measuring it on a sample which is only
15 three inches or something high, and so I have got a
16 factor there, a multiplying factor, it is really 30
17 feet, and so you have got to do a little adjustment.
18 And then you can arrive at the kind of accuracy you
19 would have to have.

20 I'm not really criticizing them
21 because they couldn't do it, because there are certain
22 things that we can't do by certain methods, you see.

23 Q I take it you haven't done
24 a calculation to determine what degree of accuracy
25 would have been required in this sort of experiment?

26 You don't know?

27 A Well no one has really
28 stated just what kind of heave is acceptable, you see.

29 Q Well you are criticizing
30 though an experiment that was carried out by these

1 engineers, and what I'm really trying to do is find out
2 precisely what it is that you consider went wrong in
3 their experiments, and I've been led to understand by
4 what you are telling me, that their instrumentation isn't
5 of sufficient accuracy to enable them to give results
6 that are meaningful. And we have talked about how accur-
7 ate that instrumentation is said to be, or thought to be,
8 and do I take it you are not able to give me the level
9 of accuracy that would have had to have been achieved,
10 in order to get results that could be used?

11 A Well I thought I had
12 explained very carefully that if you can tell me what
13 is the permissible heave acceptable in 50 years, and you
14 want to measure it in terms of an experiment over a day
15 or two, then I could tell you just by that simple piece
16 of arithmetic.

17 Q Well not having done that,
18 how are you able to attack their methodology? You say
19 in this particular case that's not sufficiently accur-
20 ate. That's what I don't understand.

21 A At any rate, the thousandth
22 of an inch that you claim, pardon me that N.E.S. claim,
23 is easily demonstrable is not good enough.

24 Q Well we can perhaps leave
25 that for rebuttal .

26 THE COMMISSIONER: Well Dr.
27 Williams, you're saying that the question of what is
28 an acceptable level of frost heave, is a matter that
29 depends upon questions of type soil and interaction,
30 that if they have postulated X is the likely frost heave,

1 that's fine because presumably they have a pipe that
2 is -- has sufficient strength to resist that heave.

3 What you are saying to me is
4 that the heave might be conceivably 2 X or 3X or 4X,
5 and if it is, and we have got a pipe that can withstand
6 it, well and good, but if they haven't, they may be in
7 trouble.

8 MR. GENEST: Could we have
9 the yes on the record, sir?

10 THE COMMISSIONER: Yes, Dr.
11 Williams nodded his head, which I take --

12 A I was saying yes to the
13 proposition that if the heave is much greater than
14 expected, two or three times, then clearly there may be
15 a problem.

16 MR. MARSHALL:

17 Q I would like to get back
18 to this discussion about the methodology that's been
19 employed by Northern Engineering in their tests, sir.
20 Are there other aspects of the methodology employed with
21 which you are critical?

22 A Well I think it was unfor-
23 tunate that there wasn't much more regard paid to the
24 theoretical knowledge that is thoroughly established
25 about the state of affairs in freezing soils. It's a
26 tremendous amount of work that went into those volumes,
27 but that doesn't release them from the criticism
28 that it's one-sided, as I said.

29 Q I'm sorry, sir, you are
30 going to have to be a little more precise than that,

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because I don't understand what you are saying.

A Well they have gone at it empirically and totally ignored a considerable body of knowledge, which I tried to introduce this morning, on the states of stress in the water in the frozen soil and so forth.

Q Well perhaps not today, because it might take us some time, but could you provide through your counsel, a list of that data which you say was ignored?

A WELL yes, I mean, yes indeed. Not data, well data as well, I mean this is a great body of published scientific knowledge. Quite considerable. Very significant, let's put it that way.

Q Well I would like you to specify those that you say have been ignored, could you do that, provide that list to Mr. Goudge?

THE COMMISSIONER: You are speaking of the body of theoretical knowledge developed over the last 10 years or so, by somebody in the United States, whose name I can't remember, and by Hoekstra and so forth, and no doubt yourself, and that Arctic Gas instead relied on the experiment they carried out, and to a greater extent than you think is appropriate?

A Yes, to make it quite clear, it's not a matter of two or three authors. There's a very substantial body of knowledge which is now drawn into our understanding of the theoretical situation, and I would be happy to supply a list of such papers.

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1 THE COMMISSIONER: Yes, well I
2 think you should. I didn't imply there were only two or
3 three, those are the only ones that came up in the course
4 of your discussion.

5 MR. MARSHALL: It may comfort
6 you a bit, sir, to know that Hoekstra is employed by
7 Northern ENgineering.

8 A Oh, I know indeed, yes.

9 MR. MARSHALL: So that aspect
10 of the work clearly has been available to them.

11 Q I wondered sir, if there
12 were any -- well just before leaving this, you say have
13 -- they have ignored a vast array of theoretical work
14 that's been done. Have there been tests, field tests,
15 if you like, to verify the approaches in these theor-
16 etical -- these various theoretical approaches?

1 A The theoretical approaches
2 you see don't address themselves to the pipeline
3 of course, I'm talking about volume knowledge. studying
4 freeze and soils. But the body of knowledge is
5 certainly supported by experimental evidence. It's
6 a combination of theoretical, considerations and, of
7 course, we don't get just believe a theoretical consideration
8 we have to find some evidence from experiment, that it
9 is correct. There has to be evidence.

10 Q Well that's precisely
11 the point, in that considerable experimental work
12 has been done, related to this project, I wonder sir
13 if there are other criticisms that you have now. We've
14 dealt with the instrumentation being in your view
15 not sufficiently precise and we've dealt with the
16 ignoring of the body of theoretical data and so on,
17 studies that have been carried out over the last number
18 of years, are there other criticisms of the approach
19 that has been taken?

20 A I would just make one
21 point clear. My criticism wasn't exactly that the
22 instrumentation wasn't precise enough in the sense that
23 they / should chosen another method of instrumentation, be-
24 cause I don't think it would have been feasible. I
25 think they should have approached the problem somewhat
26 differently so as not to get into the corner of having
27 to rely on a dial gauge measuring to a thousand of a degree
28 You see Hoekstra's work didn't involve any actual
29 measurement of the heave, to my knowledge, not any
30 actual measurement, there was no dial gauge and no attempt

1 to measure a length of change.

2 Q But that's exactly what
3 it is that they want to measure.

4 A Well it may be exactly
5 what they want to measure, although I don't agree that
6 it is, I think what they want to know is the pressures
7 that are generated by the heaving. Heaving certainly
8 occurs, we know that anyway. It's the pressures generated
9 by the heaving that are the threat to the pipe.

10 Q How do you transfer those
11 pressures into a predicted heave?

12 A Pardon me?

13 Q How then would you transfer
14 those pressures into a predicted heave?

15 That has to be known, you
16 have to have a prediction of heave in order to be able
17 to describe what pressures must be achieved.

18 A Well now you're talking
19 from an engineering point of view. It wouldn't --

20 Q That's the whole exercise.

21 A Yes. It wouldn't be
22 relevant to worry about very high pressures, that might
23 be necessary to stop an insignificant heave. That's
24 obvious, but I'm saying that we could have significant
25 heaves, very problematic heaves in associations with pressures
26 much greater than Northern Engineering Services have
27 postulated.

28 Q Let me just -- I'd
29 like to turn now to your contention that Arctic Gas are
not handling the long term effects properly. To begin

1 with, you've used the term, as I understand it, very
2 long term effects and I was wondering if you could
3 define that.

4 A I used the term in my
5 evidence, I just wondered what context.

6 Q Well I think the easiest
7 way to find it is in the two page synopsis. You say
8 "When we are concerned with very long term effects,
9 no experiment alone can tell us directly what may
10 happen."

11 A Yes, by very long term
12 I am talking about tens of years of course, and one doesn't
13 normally expect experiments to last over tens of years
14 So that's why we talk about very long term effects.

15 Q Can we be a little bit
16 more precise than tens of years, or is it not possible?

17 A Well the life of the
18 pipeline is 50 years or something.

19 Q Looking at the brief
20 statement in your evidence, you said at the bottom of
21 that first page, I'll quote it "In many experiments
22 it appears that it is only those forces generated at
23 points within a temperature of about 32 degrees Fahrenheit,
24 that is at the frost line, which are producing the
25 heave. However, over longer periods of time, it
26 appears that the pulling forces effective at somewhat
27 lower temperatures, 30 degrees Fahrenheit perhaps are
28 effective and to prevent heave occurring over a long
29 period of time, a shut off pressure equivalent to those
30 greater forces will be required." I take it that the

1 more detailed presentation that you gave really doesn't
2 change the substance of that statement?

3 A There is one small point.
4 This abstract, being what it is, deals with the commonly
5 accepted measurement of frost heave, the movement of
6 the water to the frozen layer in other words the
7 addition of previously external water, and actually
8 when I talk about the forces generated at the frost
9 line they are those in association with, the actual freezing
10 of the frost line and of course that is water being
11 drawn up you see. The question of the pressures
12 generated, within the frozen soil due to the already
13 contained water, is of course, the reason behind the
14 problem that I'm talking about here. That if you just
15 measure the pulling force of the frost line, the
16 32 degree line, then you get the sort of values
17 that I showed and indeed agree fairly well with what
18 NES showed. But when you wait a little longer, the
19 pulling forces apparently increase.

20 Q Well is it reasonable
21 for purposes of our discussion, to deal with it as
22 separate aspects. We've talked about the insitu water
23 and the contribution it has to total heave.

24 A Um-hmm.

25 Q And that's been accounted
26 for if you like as part of the total package. We've
27 dealt with that aspect of it, and you expressed your --
28 you've gone through your example of one foot, given a
29 typical type of situation.

30 A That's your foot too.

1 Q Yes right. Well then do
2 I understand that your concern then would be not
3 solely with the heave associated with temperatures right
4 at or about the freezing front, but it's at colder
5 temperatures?

6 A Yes indeed.

7 Q And this is related to
8 the water moving in through the freezing front behind
9 the 32 degree isotherm some way and the heave that
10 would be associated with that water

11 A Yes, but not exclusively
12 so. Because we do have this unfrozen water at various
13 temperatures below 32, then that progressively freezes
14 as temperature falls.

15 Q Quite.

16 A So that we are dealing
17 in part also with the contained water when we're talking
18 about these lower temperatures too.

19 Q But a conservative approach
20 that assumes that all of that in situ water freezes,
21 and produces heave, will account for all of that in situ
22 water?

23 A Yes.

24 Q And then we're left with
25 two other components --

26 A It accounts for it and
27 it's quite clear that you get a heave of a foot or whatever
28 it may be.

29 Q No argument.

30 A Good.

1 Q So then we're talking about
2 two things, one of which I take it you feel has been
3 addressed and one of which you feel has not been addressed,
4 the first being the heave that is associated with the
5 frost front itself. The water freezing at the frost
6 front?

7 A Well it's been addressed
8 in the

9 Q And the concern that
10 you've been raising is what about the water that is
11 being drawn in past the frost front.

12 A Yes indeed.

13 Q At the end of the frost
14 front and instead of freezing, producing more heave.

15 A Yes.

16 Q So that's what your
17 concern is about.

18 A Yes.

19 Q Sir, you are aware, are
20 you not, that in the experimental work that NES carried
21 out, they have used a cold temperature of 30 degrees F
22 to get their frost heave data?

23 A A cold end temperature of
24 30 degrees Fahrenheit in the laboratory experiments, yes.
25 Well I don't remember exactly but that sounds quite
26 reasonable.

27 Q So that then/for frost
28 heave associated with the range from 32 degrees to
29 30 degrees?

30 A Well it hardly accounts

1 for it, I mean within the limitations of the time that
2 the experiment took which was five days or ten days
3 or whatever, in that sense, you know, you had a piece of
4 soil that was at 30 to 32 degrees. Whether it accounted
5 for the heave, as you put it, depends on what you mean
6 by accounting for.

7 Q If we leave time aside
8 for the moment, aren't we really accounting for the
9 freezing of the water that is coming to the frost front?

10 A To elaborate on what I
11 have just said I don't agree, -- I'll be more
12 definite, I don't agree that because you actually had
13 present in the experimental set up some soil at 30 Degrees
14 F. you therefore knew all about the pulling forces
15 generated at 30 degrees Fahrenheit. You didn't, that's
16 the problem. We've done this experiment ourselves in
17 our laboratory, it's almost the same, Hoekstra's
18 experiment in water is the same too.

19 And we have found that the
20 pulling forces measured in the piece of unfrozen soil
21 underneath the frozen layer, slowly increased, so if you
22 leave the experiment running for a few days, they're
23 quite substantially greater than if you terminated the
24 experiment and there is no indication they wouldn't go
25 on getting greater and greater.

26 THE COMMISSIONER: Well I think
27 that this is a good time to adjourn for lunch and you
28 can consider your -- how you're going to make this
29 point even clearer than it is now and you might consider
30 Mr. Goudge, in re-examination, whether you can shed any

1 light on this. I keep thinking I understand what is
2 being said, but maybe I don't. Well we'll adjourn
3 until two then.

4 (PROCEEDINGS ADJOURNED UNTIL 2:00 P.M.)
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(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

THE COMMISSIONER: Carry on,
Mr. Marshall.

MR. MARSHALL: Thank you, sir.

CROSS-EXAMINATION BY MR. MARSHALL, CONTINUED:

Q Dr. Williams, can I take you back to the statement in your synopsis and proceed from there. You said on the second page of the brief summary, "There are also limited but clear demonstrations that the freezing of water at lower temperatures results in a slow heave in that much greater shut-off pressures are required to prevent this heave than has been proposed in Northern Engineering Service's studies". All right, are you with me?

A Yes.

Q Now can you tell me, sir, in terms of inches per year, what you consider to be slow heave?

A Well, it isn't a single value, but you know an inch a year is slow heave, but a range of values would come a general remark like that. A fast heave, of course, is something where you would produce inches per day.

Q Now sir, when you are considering this, do I understand correctly that you mean the heave that's behind the frost front, it's

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1 occurring behind the 32 degree isotherm in the frozen
2 soil, or am I wrong?

3 A No, that's correct.

4 It's the water at lower temper-
5 atures than 32, so it must be behind, in order to --

6 Q Okay. I just wasn't sure
7 whether I understood you correctly there. Now sir,
8 isn't it correct that most ice lensing occurs in the
9 immediate vicinity of the 32 degree isotherm?

10 A Well that would depend on
11 the availability of water in the unfrozen layers imme-
12 diately below the freezing soil, and on the period of
13 time we are talking about. The freezing that occurs in
14 a short space of time, as I think I said earlier, the
15 ice lensing, pardon me, is occurring at the time when
16 the 32 degree Fahrenheit isotherm is at that level.

17 Q Right.

18 A As time goes on, I think
19 that the lenses behind the freezing front tend to
20 grow and maybe the ones/^{right}at the freezing front even
21 cease completely to grow. It depends on conditions.

22 Q Well sir, can you give me
23 an indication of time, and I'm -- what my concern is,
24 is with respect to this point, whether or not you con-
25 sider that this is a problem during the projected
26 operational life of the pipeline?

27 A Oh, absolutely.

28 Q Well have you been able
29 to quantify this in any way?

30 A Well quantify in which

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1 way? I think I have said that I think that the pressures
2 generated by the process are much greater than Northern
3 Engineering have said. I have also said that a
4 significant quantity of heave would occur unless you
5 apply the shut-off pressure, but I'm saying the shut-
6 off pressure is very big, much bigger than we have said
7 and that is the essence of the problem.

8 THE COMMISSIONER: And if all
9 that is so, then the preventive measures Arctic Gas
10 proposes are not sufficient?

11 A Exactly.

12 MR. MARSHALL:

13 Q Well sir, my information
14 is that to take the range, say from 32 degree to the
15 30 degree Fahrenheit isotherm, that given the time
16 period that is of engineering interest for this pipeline
17 project, the great proportion of the heave would
18 occur in that area?

19 A You mean in soil which has
20 temperatures between 30 and 32 degrees Fahrenheit?

21 Q No, with respect to a
22 pipeline of the type proposed, that the vast majority of
23 the heave would be heave that would occur in that temper-
24 ature range, from 32 to 30 degrees Fahrenheit?

25 A I think that's correct to
26 say.

27 Q I think something over 95
28 percent?

29 A Well I wouldn't want to
30 put a percentage on it. One can think of particular

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1 conditions where you might arrange things differently,
2 but generally speaking it's true.

3 Q Well if, sir, you agree
4 with me that the vast majority of the heave would be
5 that associated with this temperature range, and as my
6 instructions are, the heave is being measured in the
7 Northern Engineering work that's associated with this
8 range, where do we become at odds?

9 A Well I don't agree that
10 the measurement of heave, have in fact measured the
11 heave as taking place. That's all we discussed at
12 length this morning. The apparatus only measured it
13 to a thousandth of an inch, we were told, and I'm
14 suggesting that you may have point 9 of one one-thousandths
15 of an inch

16 Q Now sir, you have indi-
17 cated that much greater shut-off pressures are required
18 to prevent the heave that has been proposed in Northern
19 Engineering's studies. Do I take it that you are
20 talking about all heave associated with the various
21 phenomena we have been discussing?

22 A Well do you mean down every
23 foot of the length of the pipe?

24 Q Well you are talking about
25 the heave associated with in situ water, heave that is
26 taking place between the 32 and 30 degree isotherms and
27 heave associated with freezing at colder temperatures
28 than that?

29 A Yes.

30 Q It's all of these

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1 components, if you like. At least to my mind they are
2 separate components. You may not --

3 A Yes, I'm sorry but now I
4 have lost the question.

5 Q Well when you said in your
6 evidence, I believe I have it right, that much greater
7 shut-off pressures are required to prevent this heave
8 than has been proposed in N.E.S.'s studies, you're talk-
9 ing about all heave associated with --

10 A Yes. What I am really
11 saying is that a much greater shut-off pressure will be
12 required over every foot of the pipeline, not at all. I
13 mean there is no heave at all if it is solid rock.

14 Q No, but in a particular
15 area, say, that you have identified as being one
16 where there is maybe some frost heave, in making the
17 statement, you are taking into account all aspects of
18 heave, that is from in situ water, heave at the frost
19 front and heave that's associated with water that's
20 migrated through the frost front.

21 A In naming a rough range
22 of maximum shut-off pressure, I have thought of every-
23 thing, is that what you are --

24 Q Yes.

25 A Well I sort of hope so.

26 Q Well, what I'm interested, sir,
27 is your quantification of this greater shut-off press-
28 ure that you're referring to, and I don't know if it
29 would help, but we could go to page 13 of your evidence
30 and you make this statement:

1 "Again, we can say that if
2 there is virtually no time limitation, then we can
3 expect very significant heaves which could only be
4 prevented by much greater shut off pressures than those
5 of 3,000 PSF or so that are indicated."

6 A Yes.

7 Q My concern is with your
8 pontification of it.

9 A You're asking me how
10 much greater than 3,000 PSF?

11 Q Yes.

12 A Yes, well that's very
13 interesting. There is a theoretical maximum at
14 100 atmospheres which is about 100 times 2,000 PSF
15 so that's not an end concern, it's a theoretical
16 maximum because actually the phase, ice change is made
17 under these high pressures. So it's something less than
18 that, that's ---
19 but I wouldn't really like to say what the actual highest
20 heaving pressure one could obtain is. Hoekstra
21 obtained experimentally values of 800 pounds per
22 square inch, multiplied by 144, that makes 800 times
23 100 is 80,000, 120,000 PSF isn't it.

24 Q Well sir, doesn't that
25 assume as you stated on page 13, virtually no time
26 limitation?

27 A To get 120,000 PSF,
28 you're not going to get that always certainly.

29 Q Well you may get it
30 ever if you like.

1 A Hoekstra after all
2 measured it in his experiments because he arranged
3 things right and established that is a feasible value.
4 But it certainly won't occur all the time along the
5 pipeline in every position, but there's a range of
6 shut off pressures and this is a matter of degree, but
7 it certainly is going to be often the case that it
8 will be, in my view, substantially greater than 3,000
9 PSF or so.

10 Q And you're saying that
11 is within say a 50 year period of the commencement of
12 operation of the pipeline?

13 A Well, I mean, we're
14 talking in sort of general regions but I think one would
15 experience pressures four or five times the 3,000 now
16 and again in a much shorter time span than 50 years
17 actually.

18 Q I take it you'd agree
19 with me that if we're talking about only reaching these
20 requirements for much higher shut off pressures. after
21 a 50 year time period, say using masses --

22 A No I am not --

23 Q Could I finish my
24 question?

25 A I beg your pardon.

26 Q Would you agree with me
27 that if as my advisors conclude, there would be no
28 concern with the requirement for very high shut off
29 pressures of the types that you're suggesting, within
30 a 50 year time period, if they are right and you are not

1 right on that or if it would take a very much longer
2 time period, that would then be of no engineering
3 consequence would it to this pipeline?

4 A Well, if you're simply
5 saying that it could be proved that the pressures were
6 always 3,000 PSF or less, so long as you only look
7 50 years ahead, then everything would be fine, but
8 in the first place, it's impossible to prove that is
9 not true, even within 50 years. The point is that
10 long before the 50 years is up, one would have exceeded
11 the 3,000 PSF essentially.

12 Q Sir, I believe it was
13 in connection with your diagram number 6, that you
14 mentioned 27,000 PSF pulling force at 30 degrees F.
15 Whereas my information is that NES in their measurements,
16 have found only about 3,000 PSF, 10 percent of your
17 figure. I wonder how it is you rationalize the
18 difference between your projection and their test
19 results?

20 A I think it's quite
21 clear. What's happened is that they're dealing with
22 the pulling force which is being generated at the
23 frost line primarily and you'll see that in my case.
24 31.9 degrees Fahrenheit, I've got 1,350 PSF which is
25 below the values that were actually measured by NES.
26 But they must have therefore been counteracting the
27 pulling forces which were actually being generated at
28 about, well 2,000 PSF, it would be about 31.7 or something
29 degrees Fahrenheit.

30 Q The test was run at 30

1 degrees.

2 A Well no, the test was
3 not run at 30 degrees, the coldest part of the sample,
4 I think we said this morning, or you said this was 30
5 degrees but the warmest part of the frozen earth was
6 32, and the warmest part of the sample was something
7 above 32.

8 Q Well sir, if at 30
9 degrees they ought to have 27,000 PSF pull, why in your
10 view aren't they measuring that?

11 A Because the way the ex-
12 periment was set up the shut-off pressure was defined
13 as the pressure you had to apply to the soil column as
14 a whole to prevent water entering at the base of the
15 frozen layer, which is the 32 degrees fahrenheit or
16 thereabouts position and so the pressures they were
17 measuring were those corresponding to that temperature.

18 Q I think you have lost me
19 on that point, could you go back through that again sir.

20 A Yes. You were asking me
21 why they didn't measure the higher pressures, well
22 I have shown that when you have a sample of soil, the
23 coldest part of which, for example is at 30° F. and the
24 warmest part of the frozen soil is at 32, then there are in
25 fact developed a range of pulling forces in the soil.
26 I have shown it in the diagram and the question is which
27 of those were they in effect measuring.

28 Q I see, you say you don't
29 think they were measuring what is happening at 30° F.

30 A That is right, exactly.

1 Q Sir if through two inches
2 of frozen soil you can't feel the effects of the 30
3 degree pulling force, when are you ever going to feel
4 it?

5 A Well in our own experience,
6 if you wait a little while, I may have said this this
7 morning, one finds that the pulling force when measured
8 on the water directly -- we used as slightly different
9 technique, we actually measured directly the pulling
10 force on the water by measuring the pressure state of
11 the water, O might say.

12 Although it appears as you
13 freeze the soil, the very rapidly the pulling force
14 develops and then evens out and you think ah, that's
15 it, that's the shut-off pressure, maximum pulling force.
16 If you leave the experiment running, you find it hasn't
17 actually levelled out, but it's going up very slightly
18 and it goes on going up. increasing the pulling force.

19 THE COMMISSIONER:

20 Which means you need a greater shut-off?

21 A Exactly, yes.

22 MR. MARSHALL:

23 Q And how long would they
24 need to run their tests in order to get this higher
25 shut-off pressure?

26 A To get the maximum, you
27 mean? Well, that's very problematic, I mean there's no
28 evidence that it sort of stops going up, so that I
29 am inclined to say that if you could wait an infinite
30 length of time, you would ultimately measure in each

1 case, the highest pulling force for the high, coldest
2 temperature you developed. That sets the limits. I
3 haven't actually been able to do that. One thing you
4 can't measure pulling forces, which are stresses
5 of thousands of Psf's, it can't be done. You can't
6 measure them directly I should say in the way we have
7 tackled that.

8 Q Sir, I want to turn to
9 your discussion about a concern that there may be an
10 overstress of the pipe.

11 THE COMMISSIONER: Well Mr.
12 Marshall, that's a new subject, I take it?

13 MR. MARSHALL: Yes, sir.

14 THE COMMISSIONER: You have
15 said, Dr. Williams, and let me make sure I understand
16 you, that you're unhappy with the approach that Arctic
17 Gas has taken because it is empirical, and does not take
18 sufficient heed of the very important theoretical work
19 done in the past 10 years by many in the field.

20 Then you turn to the experiments
21 and you say at the very outset that they do not take
22 into account the presence of water, that is, water as yet
23 unfrozen in -- within the frost bulb, which given the
24 -- which may itself become converted to ice. Then you
25 object to the sufficiency of the measurement of the
26 heave because the gauge does not account for -- is only
27 accurate to one one-thousandth of an inch, and finally
28 you say that their experiments do not take into account
29 the phenomenon that you have observed, that is, that
30 the pressure actually increases with the passage of time.

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1 Presumably then the rate of frost heave increases with
2 the pressure -- increases with the passage of time.

3 A The rate of frost heave,
4 you would think so, sir, but the reason it doesn't
5 necessarily is because the colder the soil gets, the
6 -- this hydraulic conductivity decreases, so that
7 there is actually less unfrozen water, so although the
8 assumption you make is inherently correct, when you look
9 at it the soil is changing insofar as there is gradually
10 less channels for the water to move through, so that
11 the net result is the rate of heave won't necessarily
12 be greater although the pulling force is greater.

13
14 THE COMMISSIONER: Subject to
15 that, have I, in a very rough way, summarized your
16 concerns about the approach Arctic Gas has taken?

17 A Yes I think so except you
18 did stress the fact that they, according to my viewpoint,
19 had failed to measure the volume of heave with the dial
20 gauge, and Mr. Marshall raised that question. I wasn't
21 very concerned about the fact, because they didn't in
22 their report, really make any great claims they had
23 measured it to the required accuracy. The report is
24 based on stopping the flow of water into the bottom of
25 the soil, but I'm saying that that's not really enough,
26 just to stop the water flowing into the soil.

27 THE COMMISSIONER: Because the
28 water is already there?

29 A Well that's another aspect
30 and it's going to be --

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1 THE COMMISSIONER: And it may
2 freeze?

3 A Yes.

4 THE COMMISSIONER: Even though,
5 according to --

6 A There are really two
7 separate pointsof view here --

8 THE COMMISSIONER: Yes.

9 A Or not pointsof view,
10 two separate aspects, one is that the tendency to pull
11 water in from the water source below increases with
12 time, because the pulling force is increased.

13 The second question is the
14 one we debated at length about the contained water, and
15 I am saying while I think it was freezing at the differ-
16 ent temperatures, but they didn't show it directly
17 because they haven't got a gauge that was sensitive
18 enough to show it.

19 THE COMMISSIONER: Well carry
20 on, I just wanted to make sure I was on board to this
21 particular station.

22 MR. MARSHALL:

23 Q Now sir, dealing with the
24 concern you expressed about overstressing the pipe,
25 and you talked about the tolerable limits being, say
26 three inches in 100 feet of pipe, just to make it clear,
27 as I understand it, you are only considering the heave
28 aspect. You are not considering the soil pipe inter-
29 action, if you like, the behaviour of the pipe
30

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1 A I think that you are cor-
2 rect to say.

3 Q That involves a stress
4 analysis that is something that you have not been in-
5 volved in?

6 A M'hm. I mean if the
7 heave occurred in some way that didn't induce a similar
8 deformation in the pipe, and only the pipe people can
9 tell me that, then we are talking about different
10 questions, as it were. I don't know anything about the
11 strength of the pipe.

12 Q Sir, you dealt with in
13 the last questions concerning the problem under river
14 crossings, and you were asked about what could be done
15 about any heave problem there, and I believe the point
16 was mentioned that you can't really berm it because it's
17 under water. You can't apply a surcharge under water.
18 You can though, go to deeper burial?

19 A M'hhh.

20 Q And you in effect get the
21 same overall shut-off pressure that you would get if
22 you were to apply a berm?

23 A Yes.

24 Q So that would be one
25 technique that could be employed?

26 A Yes, because the point is
27 that the shut-off pressures are so big in my estimation,
28 that it is neither feasible to build a berm that high,
29 nor to sink that pipe that deep below the river.

30 Q That's assuming that your

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1 views as to the shut-off pressures are correct?

2 A Yes.

3 Q Now sir, you dealt with
4 but I don't think came to a specific recommendation on
5 the point of that this chilling should stop, and I was
6 wondering in considering your analysis as to frost
7 heave versus frost settlement, you considered the impact
8 that thaw settlement might have on slope stability, or
9 is this something that is out of your area of --

10 A Well my group was con-
11 asked to consider sections relevant /^{to} slope stability,
12 and it was a colleague of mine who did that and we dis-
13 cussed the conclusions which I was not in opposition to.

14 Whether I could remember the
15 details, I don't know, perhaps it would be correct to say
16 that if we sent a report to Dr. Fyles' office discussing
17 the slope stability aspects in some detail, and I think
18 his feeling was that this would broaden discussion and
19 perhaps it was better to concentrate on the aspects
20 that I have talked about.

21 MR. MARSHALL: I wonder, Mr.
22 Goudge, if we could have a look at that report?

23 MR. GOUDGE: Yes, sir.

24 A Could I just add one thing
25 that occurred to me just when you began with your last
26 question. When I talked about the river crossing, the
27 unfeasibility of burying the pipe deep enough, we are
28 talking about the worst cases all the time, and there
29 would be the odd situation where the heaving pressure
30 isn't so great. We're clear about that. We are talking

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1 about the worst heaving conditions, aren't we?

2 Q I think --

3 A You know, if there is some
4 bed rock on the base of the river, you might anchor the
5 thing to the bedrock or something, I don't know.

6 Q Oh, quite. We are talking
7 about the example that you were using of where heave
8 might occur at river crossings.

9 A Yes, yes.

10 THE COMMISSIONER: Dr. Williams,
11 can I just go back to what you said about river crossings?
12 Let's take the crossing of the Mackenzie south of Fort
13 Simpson. That would be a zone of discontinuous perma-
14 frost, I have forgotten what the nature of the soil is
15 beneath the river, but let us assume it is susceptible
16 to frost heave, that is soil that is susceptible to frost
17 heave.

18 Now, what you are saying is
19 that you can't do anything to prevent frost heave under
20 the river, that is you can't replace the soil that is
21 susceptible to frost heave, with non-susceptible soil.
22 You can't bury the pipe twice as deep as you intended
23 to, because that won't work. You can't build a berm on
24 top of the river bottom, so you have a situation in
25 which you have frost heave, and there's nothing you can
26 do about it? Is that where we are at?

27 A Well firstly if I could
28 just make one comment, you talked about the Mackenzie
29 River, and I think you said up in the permafrost zone --

30 THE COMMISSIONER: No, no, in

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1 discontinuous permafrost zone.

2 A Yes, but what I wanted to
3 say that as far as we know there's no permafrost under
4 the entire length of the Mackenzie route.

5 THE COMMISSIONER: All right,
6 well then that makes my example even better, I think,
7 doesn't it?

8 A Well yes, that's a matter
9 of detail. Well I don't know whether it's absolutely
10 impossible to get around the problem, but the suggest-
11 ions you have made of a bigger berm, that really
12 obviously seems to me impossible. Sinking the thing
13 deeper is impossible for the same reason, really. I
14 suppose one could think of some idea of anchoring to the
15 bedrock, as I said, if that's not too deep. Perhaps
16 encasing the whole thing in concrete. Not in frozen
17 ground, because that isn't really much like concrete,
18 so I certainly agree with you and I certainly haven't
19 any solutions or suggestions on how to put the pipe
20 through a river crossing, but if the straight question
21 was, "Is it absolutely impossible", and I don't think
22 one could say that, there may be some very expensive
23 way of doing it.

24 THE COMMISSIONER: Yes, yes,
25 well I just wanted to know how far you were going with
26 that proposition.

27 MR. MARSHALL:

28 Q I believe it was in --

29 THE COMMISSIONER: Excuse me,
30 Mr. Marshall, forgive me. When your witnesses gave

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1 evidence did they propose as the solution to frost
2 heaving under the major river crossings, did they propose
3 as the solution to that, that you should go to deep
4 burial? Was that the solution they proposed?

1 MR. MARSHALL: Yes.

2 THE COMMISSIONER: And you say that is
3 no solution to frost heave?

4 A It's basic to my views
5 that the shut off pressure is so high. that it would
6 be unfeasible to dig it down so deep.

7 MR. MARSHALL: Q That's really the point
8 of departure I think. If the Arctic Gas people who
9 have been looking at this simply don't accept a much
10 higher shut off pressure, within the time frame of an
11 operational pipeline that the witness is suggesting
12 he thinks will be there.

13 A I understand that.

14 Q In terms of solution in
15 the river crossing, yes, deeper burial was --

16 THE COMMISSIONER: Deeper
17 burial was your solution. Dr. Williams says that
18 that won't work because of a very high shut off
19 pressure so we have a difference of opinion of very
20 great importance.

21 MR. GENEST: That applies
22 as well to the pipe in non- river crossings.
23 I don't think the presence of the pipe under the river
24 makes any difference to Dr. Williams views as I under-
25 stand them. He said the deep burial or berm will not
26 solve this problem of high shut off pressure. Whether
27 it's under river or on the ground.

28 A That's correct. One
29 thing, an entirely different point of view on the same
30 problem, if everything was fine and the only problem was

1 the river crossings, then it might be possible to
2 tunnel. I mean it's very expensive but go down by a
3 tunnelling procedure, so that it was deep enough, but
4 I mean it's tremendously costly procedure.

5 THE COMMISSIONER: Well
6 tunnel --

7 A By tunnelling I mean
8 deep tunnelling, going down deep enough that you in
9 effect have sufficient overburden.

10 THE COMMISISONER: I'm trying to remember the
11 depths we were concerned with, going under the Mackenzie
12 River,

13 MR MARSHALL: That's 25
14 feet or so.

15 THE COMMISSIONER: About 25
16 feet under the river bed. How deep would they have to
17 go by tunnelling to have a sufficient surcharge.

18 A It would be very deep,
19 and that of course is the key question, how big is
20 the shut off pressure actually, and I'm suggesting it's
21 quite likely that you would quite frequently find it was
22 five times as much as has been suggested so you would
23 need to be 100 foot down. The tunnelling people wouldn't
24 necessarily hold for that, but it really changes the
25 picture because you can't suddenly drop down and go
26 under/^{the river}and come up again, you have to start tunnelling a
27 substantial distance away.

28 Q Some miles?

29 A I don't know about miles,
30 it's a matter of this inflexion ---

MR. MARSHALL:

Q Getting to the point I was about to raise, as I recollect it was during Mr. Hollingworth's cross-examination, that you discussed rates at which water can move in frozen soil. You were asked a question about that and you made a reference to some research that had been done including some done by Dr. Harlan. If I understand the issue sir, it's a question of the time over which this is occurring. My understanding is that the time scale is such that having regard to this project, it's really of no engineering consequences. That is, the rate of migration of water through the frozen soil is so slow, given the time scale that we're concerned with here, this doesn't create a significant problem?

A I don't agree. The values we have mentioned for hydraulic conductivity they vary from soil to soil, but looking at my own graph, you see values --of course it depends on temperature but ten to the minus seven, ten to the minus nine, these are not terribly small permeabilities.

I was going to say they, are also met with in unfrozen clays and so on and we all know that water moves in unfrozen clays and the whole problem of building high buildings on clay, then settled, because the water slowly moves away from underneath and it's the same problem really in this respect.

Q Sir, I was directed to your paper, "Ice Distribution in Permafrost Profiles". where in you make reference to Hoekstra's work and you make

1 this reference at page 1385 "Hoekstra" in 1966 has shown
2 the rate of water migration to be very slow, but it
3 would be expected to occur substantially on a geological
4 time scale".

5 A Yes.

6 Q Perhaps I should finish
7 the paragraph, just to make it complete. "There
8 may thus also be some slow transference of moisture
9 from outside the permafrost to give some increase in
10 the bulk moisture content. However, this would be
11 very limited. The moisture content observations gives
12 some evidence of this.

13 Now, this is a correct and
14 true statement, isn't it sir?

15 A Oh yes, one point is that
16 that paper you quoted from precedes the relevant paper of
17 Hoekstra this is 1969, the paper of Hoekstra that I've
18 used.

19 Q This is your quotation.
20 of 1968.

21 A Of 1968, it's not
22 quoted from this paper of Hoekstra's. It is quoted from an
23 earlier paper of Hoekstra's which was somewhat --

24
25 But in any case, I was
26 addressing myself to a geological problem. That is why I refer
27 to a geological time scale, I'm saying it would happen
28 on a geological time scale. What I'm saying is it will
29 happen on an engineering time scale, to a degree that's
30 significant.

1 THE COMMISSONER: That's the same time
2 scale, you're just applying a different adjective.

3 A Looking at a little
4 different part of the time scale.

5 It isn't exactly the geological time we are talking
6 in tens of thousands of years, but again, it's a question
7 of how much accumulation of ice is important and I
8 must say a three inch ice layer geologically isn't
9 anything to get terribly excited about, but you might,
10 from a geotechnical point of view.

11 MR. MARSHALL: Q The problem I've got
12 is I took this reference, you say it could be expected
13 to occur substantially in the geological time scale,
14 to mean thousands of years, that's what I understood
15 your geological time scale was.

16 A Well, the paper was
17 not written with the emphasis on time scale, but it's
18 written from a geological point of view. The object of
19 these remarks was in connection with an attempt to
20 explain the presence of frost heave soil way deep down
21 where the overburden pressures, according to -- if you
22 accept NES's point of view, you should have stopped them
23 forming. Well we see them there and my paper of 1968
24 provides an attempt at explaining it, perhaps in rather
25 more -- I say, speculative terms than I've used today.

26 Q Well then you're backing
27 away are you from your substantially on a geological
28 time scale when you say that that's --

29 A Not at all, it would
30 be very substantial on a geological time scale, and

1 on a geotechnical time scale of
2 50 years.

3 THE COMMISSIONER: You said
4 you used the one inch of frost heave in a thousand
5 days.

6 A Yes.

7 Q Taking the allowance for
8 error in that gauge?

9 A Yes.

10 Q The Calgary Frost
11 Heave Institute, whatever they call it. That's an inch
12 in three years, which you said taking that rate of
13 frost heave, could be significant on the engineering
14 time scale we're dealing with here, which is -- I don't
15 know where 50 years came from, I thought this was a 30
16 year pipeline, maybe it's a 20 year pipeline, I forget,
17 but in any event, that would be significant on that
18 engineering time scale, and significant as well as it
19 proceeded on a geological time scale extending over
20 thousands of years. There's nothing in the this except
21 semantics is there?

22 A No, nothing at all as I
23 see it. The term geological time scale means that
24 it applies, if we're thinking of geological formations,
25 which we think of as very ordinary/there's nothing to
26 rule out the possibility that it will be important on
27 a geotechnical time scale. but that wasn't the issue at
28 hand.

29 MR. MARSHALL:

30 Q Well sir, the problem I've

1 got with this passage is I understand you to be saying
2 that the rate of water migration would be very slow and
3 you're relying on Hoekstra. It may be substantial on
4 a geological time scale but you'll agree with me that
5 is understood in your profession means thousands of
6 years, there may be some slow transference of moisture
7 from outside the permafrost, however you said this
8 could be very limited, then you make reference to
9 some experimental data, as I understand it, field data
10 that confirms this. You say the moisture content
11 observations give some evidence of this, e.g. figure
12 three. Now it seems to me that's a fairly strong
13 position that you've taken there and as I understand it
14 now you're modifying that very substantially, instead
15 of being a matter of significance on a geological time
16 scale, say a thousand years, you're talking about it
17 being an important consideration in a very much shorter
18 time frame. I want to know how you get from one opinion,
19 which to me, seems to be so definite to another one which
20 seems to be so definite. They're very different.

21 A I don't agree that the
22 opinions are contradictory. Actually the point about
23 figure three is that it demonstrates that the shut off
24 pressures are very great indeed because there would be
25 these ice lenses forming deep, deep down in the
26 ground. They came up in bore holes, put down by the
27 oil companies of course, or NEC or somebody and the
28 questions was, how did it form. because even then we
29 knew that overburden pressures should stop ice lensing
30 as we saw it in those days and there they were forming

1 or formed already. I say that the movements of water
2 flow, well this actually is a relatively term, they
3 certainly flow compared to what we have in highway
4 practice, but in addition, I think I say somewhere in
5 the paper that the water may in large measure be
6 the already contained water, and we've already decided
7 that could produce a foot of heave in the 30 feet of --

8 Q I think you've agreed with
9 me or Dr. Slusarchuk that that's been taken separately
10 into account on a conservative basis. I'm sorry to
11 belabour this but I still don't understand how you
12 get from the opinion that you've expressed at page 1385,
13 where it's a concern over a long period of time, to
14 the point really of it's almost of immediate concern.
15 I don't follow that.

16 A Well, as the Commissioner
17 said, this is a matter of semantics. I was talking about
18 what we saw as a geological problem and I just confirmed
19 that it was all quite reasonable in my interpretation
20 in geological time scale. It's perhaps unfortunate I
21 used the word time scale with reference to the argument
22 we're having now. Had I said geological context, there
23 wouldn't be any argument. But it in no way rules out
24 the fact that I now believe that it occurs, significant
25 amounts of pressure develops, on a ten year or something
26 like that basis, several years, maybe even less.

1 If I could add one point
2 there, I don't fully recollect my paper in detail, but
3 I may be making fairly general statement there that on
4 a geological time scale, there could be a lot of this ice
5 all over the place, because the longer you have, the
6 more there would tend to be. That might have been why
7 I used the words "geological time scale".

8 Q Well sir, the reason we
9 get into it is that I understand that the Northern
10 Engineering engineers in their research that they have
11 conducted in Calgary, have not been able to detect any
12 heave associated with these temperatures lower than
13 30 degrees. At the site where they have been running
14 the tests for some 18 months, and the heave gauges
15 behind the 30 to 32 degree range, don't demonstrate
16 that there's any heave occurring there, and that is why
17 we have this difficulty with your suggestion.

18 A Well I don't know, one
19 year --

20 Q Eighteen months.

21 A Eighteen months. Heave
22 gauges, you know, I don't want to suggest any kind of
23 sort of incompetence or anything like that, but that
24 kind of paradox if it is really clearly there, does
25 exist very frequently and one would want to know why.

26 I agree that if you are really
27 sure those heave gauges are really accurate, it might be
28 very interesting to ask why precisely nothing has
29 happened, but I don't believe actually that the reason
30 that heave gauges are milled to a thousandth of a

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Cr. Exam. by Mr. Marshall

1 degree.

2 Q - Dr. Slusarchuk has the
3 results here, if you want them.

4 A Well I would be interested
5 in seeing them.

6 THE COMMISSIONER: Mr. Holling-
7 worth, we talked about the burial of the pipeline beneath
8 the major river crossings. Arctic Gas says it is bury-
9 ing the pipe 25 feet beneath the major river crossings.
10 How deep is your pipe proposed to be buried?

11 MR. HOLLINGWORTH: Thirty feet.

12 THE COMMISSIONER: Thirty feet.
13 Well that wouldn't make any difference, I don't suppose
14 to you, would it, Dr. Williams?

15 A Only insofar as there
16 would be a few areas where it would make things correct,
17 but it would just slightly reduce the number of problem
18 cases. It isn't really very helpful in the overall
19 problem which is that there would be far too many at
20 very high pressures, really.

21 MR. MARSHALL:

22 Q Sir, I have another area
23 related to permeability, and your slide number 5, as I
24 understood it, showed permeability dropping very con-
25 siderably, as I understand it, am advised, between 32
26 degrees and 30.9 degrees Fahrenheit, by your lowest
27 temperature. There was a drop in the order of 2 to 3
28 magnitudes of permeability.

29 A M'hmm.

30 Q With a much colder pipe,

1 wouldn't the permeability be reduced even more and be
2 much, much lower?

3 A Well that is a very
4 interesting question. You will notice that the curves
5 flatten out substantially, and if you just extrapolated
6 my curves, certainly the rate of fall-off is radically
7 changed. I mean, you would have to get down to a very,
8 very low temperature, minus 40 or something, to have
9 the next order of magnitude lower.

10 I think we know the reason
11 why this is so. The decline in the amount of unfrozen
12 water that remains in the frozen soil, is as you freeze
13 the soil and cool it off, more and more water freezes,
14 but that evens out too, and we find there's a persistent
15 quantity of water that doesn't decrease very much until
16 you get to quite low quantities.

17 In other words, the unfrozen
18 water content versus temperature have the same
19 form.'

20 I might even go further and
21 say that from those curves, short of something quite
22 unexpected happening, these two bottom ones are never
23 going to be another order of magnitude less.

24 Q The last point I wanted
25 to discuss with you is perhaps just a point of inform-
26 ation. There was a discussion about the active layer
27 over the pipe, and you were being asked whether or not
28 it would disappear completely, and the information that
29 Northern Engineering have obtained from test sites, is
30 that there is an active layer over the refrigerated

1 pipe. At Prudhoe Bay, even at the test site at Prudhoe
2 Bay, so the active layer never disappears completely.

3 I think those are all the
4 questions I have for now, sir.

5 A Is that a question or just
6 a comment?

7 MR. MARSHALL: Just a comment.

8 THE COMMISSIONER: Any re-
9 examination?

10
11 REDIRECT EXAMINATION BY MR. GOUDGE:

12
13 Q Do you have any comment
14 on the comment, Dr. Williams?

15 A No, merely to say that as
16 I stressed, it all depends on the ground surface cover
17 whether there would be an active layer or not. It
18 doesn't surprise me a tiny bit that over this test site,
19 for all I know it's bare soil, and I would certainly
20 expect the heat of the summer to thaw a bit of the
21 ground in the summer, but I am simply saying that I am
22 certain that there are positions where a dry, moss
23 cover or something like that would be sufficient to
24 prevent the sun's heat getting in in the summer, and so
25 there would, in effect, be no active layer.

26 I'm not quite sure why it's
27 so important, actually, but --

28 Q Just one or two questions,
29 if I might, Dr. Williams. You spoke, in answer to my
30 friend about the need to put the pipe perhaps a hundred

1 feet under the river is the order of magnitude that you
2 speak of is correct. In the order of magnitude that you
3 speak of is correct, would the same be true for the
4 height of berm necessary when we are speaking of the
5 pipeline in general, rather than --

6 A Well if you are going to
7 go to tunnelling, you want to make absolutely sure that
8 you do put it down deep enough obviously, and also that
9 you, on the other hand, don't put it too deep, because
10 it costs more money to go deeper. So you would look
11 very, very carefully at every possible way of trying
12 to figure out what would be a reasonable depth to put it.

13 What I would say is that when
14 you talk about the non-river areas, then there are going
15 to be places where the shut-off pressure is even more
16 than would be counteracted by a hundred foot of over-
17 burden, but they might not be very frequent. I don't
18 know, I mean that kind of thing depends on the -- almost
19 the meter by meter site conditions, soil types and so
20 on.

21 So I think if you're asking me,
22 what would be a good depth to bury the pipe to, to
23 expect the depth of burial to counteract the overburden,
24 perhaps -- counteract the heaving pressure, I think it
25 would be very hard to say, exactly. You can calculate
26 the required depth.

27 Q Well let me ask it this
28 way. If the shut-off pressure required is four or five
29 times the shut-off pressure predicted by Arctic Gas,
30 is the berm necessary four or five times the height of

1 the berm contemplated by Arctic Gas?

2 A Yes, essentially so. You
3 see the berm is presumably measured, the height of the
4 berm from the ground surface, and you have already buried
5 the pipe a little bit in the ground, and there's all
6 sorts of details about effective stress and so on, but
7 that's the general idea, that it's proportional.

8 MR. GOUDGE: Thank you. Those
9 are all the questions I have.

10 THE COMMISSIONER: Dr. Williams,
11 we've had a number of witnesses, very distinguished ones,
12 of course, discussing frost heave. They're people whose
13 background is -- appeared to me to be somewhat different
14 from your own, and you were at Oslo University and you
15 were connected with the Norwegian Geotechnical Insti-
16 tute, and you have a degree from Stockholm University.
17 Are the Scandinavian countries engaged in research into
18 the behaviour of frozen ground when you try to build in
19 it, or build a building on it or a pipeline through it
20 or a tunnel under it?

21 A Yes, it's a very interest-
22 ing point. The Norwegian Geotechnical Institute as a
23 number of people present know, has grown into a rather
24 distinguished geotechnical research and consulting
25 organization, and through the years they have had, as
26 a relatively small part of their work, responsibility
27 for studies of frost action, more particularly in con-
28 nection with highways than frost heave in roads.

29 This has now been developed to
30 a great extent in a very impressive program, and they

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1 now have an institute, you could call it, with units in
2 the different universities, intensely studying these
3 kind of problems, but it's centred on the highway
4 problem, they don't have permafrost to any degree of
5 consequence in Norway, and the pipeline work in Norway,
6 of which there is a vast amount, concerns the North
7 Sea oil, it's ocean engineering, but you have the two
8 aspects but they are not linked, but their knowledge
9 of frost action and frost heave in my view, -- well at
10 the risk of sort of casting aspersions on the United
11 States, I think the Norwegians, in relation to the size
12 of their country, are making the biggest contribution
13 in the field at the present time.

14 THE COMMISSIONER: Well quite
15 apart from casting aspersions on the United States,
16 where does Canada fit into this ranking?

17 A Well that's another very
18 interesting question which I really feel very concerned
19 about. I think it's unfortunate that we have so
20 few people who have been trained in this field. We are
21 a country with a huge northern area. I think it's
22 really bad that through the 60's there was this failure
23 to make some incentive to university people to take
24 this up as a field of study. The faults lie partly
25 with the universities, perhaps, partly with government
26 policy of financing research and education, of course.

27 So although excellent people,
28 we have people -- a sort of friendly network of people
29 who study these things in Canada, and it's very interest-
30 ing and the people are doing good work, I think it's

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1 out of proportion to the needs of the country. It's
2 too small.

3 THE COMMISSIONER: one final
4 thing. You said that you were now at the Scott Polar
5 Institute?

6 A Yes.

7 THE COMMISSIONER: That I
8 assume is in England?

9 A Yes.

10 THE COMMISSIONER: WELL, what
11 do they do there?

12 A The Scott Polar Research
13 Institute was founded in 1925 or so in memory of Scott,
14 who died on his expedition. It has since become an
15 international centre for research relating to the polar
16 regions. The word "polar" has become interpreted more
17 and more loosely. You don't necessarily have to be
18 working inside the Arctic Circle, let alone within a
19 sort of practical distance from the Pole, and it's a
20 centre for studies of -- well to take one area, there
21 are people very interested in work on pipelines in
22 Russia and Canada and so on, in the northern areas.

23 It spans a range of interests
24 from physical science through to socio-economic aspects.
25 There is a specialist on Mongolian peoples and a
26 specialist on natural resources in the north and so on,
27 and one of their ways of operating, which perhaps
28 arises in connection with the initial financing of the
29 Institute, is that they have provision for international
30 visitors, and that's really what I am, and they make

1 international people very welcome, and international
2 visitors. I think it would be true to say, they are
3 to some degree, a sort of international clearing house
4 for polar research. The library is very esteemed and
5 people come from far away to study there.

6 THE COMMISSIONER: Well thank
7 you very much, sir.

8 Any questions arising out of
9 anything I put to the witness?

10 Well thank you, very much, Dr.
11 Williams, for sharing your knowledge and experience
12 with us, and we wish you a safe journey back to the
13 United Kingdom, and I have a feeling we may not have
14 seen the last of you.

15 Thank you very much, sir.

16 DR. WILLIAMS: Thank you.

17
18 (WITNESS ASIDE)
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30

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1 MR. GOUDGE: And my next
2 witness is E.B. Owen. Perhaps we could just stretch
3 our legs for a few minutes while while his slides get
4 set up. We have some slides to go with the presentation.

5 THE COMMISSIONER: Yes.

6 (PROCEEDINGS ADJOURNED)

7 (PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

8 MR. GOUDGE: Mr. Commissioner.
9 E.B. Owen is our next witness and I take he's been
10 sworn.

11 E.B. OWEN: Sworn

12 DIRECT EXAMINATION BY MR GOUDGE:

13 Q Mr. Owen, you're
14 presently with the Geological Survey of Canada as I
15 understand it, is that correct?

16 A Yes, that's correct.

17 Q What's your position
18 there?

19 A At the moment I'm a
20 physical scientist.

21 Q And just to remove any
22 lingering doubts, you're appearing in your personal
23 capacity and not as a spokesman of the government?

24 A Yes, that is correct.

25 Q Could you give the
26 commissioner please a brief resume of your educational
27 background?

28 A I graduated from the
29 University of Western Ontario in 1938 with a B.A. in
30 Geology and following this I took two years Post Grad

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1 work at Queens in Kingston Ontario in Geology and
2 Mining Engineering, and in 1952, I was sent down to
3 Louisiana State University, courtesy of the United
4 States Geological Survey for a course in ground water
5 hydraulics.

6 Q Now Mr. Owen, could
7 you review your professional experience for the
8 Commission please, in a brief way.

9 A I hope you don't mind if
10 I read it. I moved around so much in the last 25 or
11 30 years, that I just can't possibly remember all the
12 dates in order.

13 Q Go ahead please.

14 A Following graduation
15 from Queens I worked for Noranda Mines as a development
16 engineer, chiefly in the Timmins area for Holdor and Pamor
17 underground and on surface. Following three years in
18 the Army and the Engineers and Artillery Survey, I
19 hired on with the Geological Survey of Canada, first
20 as a geologist, then as a scientific officer and now
21 as a physical scientist.

22 On my first job with the G.S.C.
23 was working on dam sites in the Columbia River. This
24 was the first work that was done on the dams which
25 are now the Duck and the High Arrow and the Mica.
26 I was out there a year and in 1948 I came over to
27 Churchill, I worked in Churchill when they moved the old
28 Army townsite up to the rock outcrops where all the
29 permafrost was. This was my first experience in perma-
30 frost and at that time there was very little known about

1 it. Subsequently of that, I went down to P.E.I. and
2 there was a great shortage of gravel on Prince Edward
3 Island, they were hauling it in from the mainland and my
4 job was to find granular material, at the same time
5 I worked on the road between Charlottetown and Summerside.

6 That fall I went over to the
7 Bay of Fundy National Park and worked at a golf course,
8 swimming pool, houses, water wells and what have you,
9 for the Department of Indian Affairs.

10 After that I was down in the
11 Cornwall-Cardinal area the St. Lawrence River, looking for
12 -- mostly for granular materials because at that time,
13 they knew the St. Lawrence Seaway was going up through
14 and they needed construction materials. AT the same
15 time I was working on ground water resources throughout
16 that area, as well as around the Ottawa area. Subsequently
17 to that, I was six years -- five years with the -- two
18 years with the St. Lawrence Seaway Authority in Cornwall,
19 five years in the St. Lawrence Seaway Authority in
20 Montreal, and then after the Queen Elizabeth put her
21 yacht through the St. Lambert lock in the spring of
22 59, I was sent to Dawson City in the Yukon where I
23 spent eight years working on dam sites, road construction,
24 river diversions and what have you . At that time I was
25 on loan to the Water Resources Branch of what was then
26 the Department of Indian Affairs. Subsequently to that,
27 I came back, and I was put back with the Seaway
28 Authority where they were building a new canal in Welland,
29 and I spent until 1970 there. I spent most of my time
30 with the Seaway but still I was working on river diversion

1 works in northern Ontario, and worked with the United
2 States Corps of Army Engineers when they dewatered the
3 American Falls, and then when they got the seaway
4 finished in 1970, I was seconded to the Department of
5 Indian Affairs. I've been with them pretty well ever
6 since.

7 Representative projects
8 during this time with Indian Affairs and these are only
9 representative, I have two pages of reports but the
10 land use regulations in the Northwest Territories and
11 the Yukon, I was actually taken in to Indian Affairs
12 to work on these land use regulations. That was the
13 reason why I was taken from Niagara Falls into Ottawa.
14 I worked on the Pointed Mountain Pipeline, I was there
15 from the time it started until it was practically ended.
16 I spent a year and a half on granular materials inventory
17 in the Mackenzie Delta, resulting, of course, in all
18 these well known granular material maps, some 23 which we
19 produced. I worked with the DPW on the Mackenzie
20 Highway. I helped with Pits and Quarries Legislation
21 which is not law by any means yet but somewhere in the mill
22 Up in the DEW Line sites, I was interested -- Indian
23 Affairs actually were interested in rehabilitation of
24 some of their airstrips, abandoned and otherwise.

25 I spent considerable time working on dam sites on
26 the rivers flowing from the Mountains Richardson
27 and those mountains east into the Mackenzie. This was
28 was a continuation of the, ^{eight} years I spent in the Yukon
29 doing a dam site investigation there.

30 At the present time, -- then of

1 course, I was over to the USSR on a pipeline inspection
2 trip in 1973, At the present time I've just finished
3 doing a granular material survey of Hay River. I worked
4 at a wharf job in ~~The~~ Bay of Chaleur in New Brunswick, at
5 Dalhousie and I've just finished a report on the
6 monitoring -- we hope to do a monitoring study of cut
7 slopes on the Mackenzie Highway. Cut slopes and perma-
8 frost in the Mackenzie Highway. That brings me up to
9 now.

10 Q Thank you very much, Mr.
11 Owen. I wonder if you could now proceed to deliver
12 your evidence on the Pointed Mountain Gas Pipeline
13 construction and terrain performance along the right
14 of way, please.

15 A This, you understand,
16 is an synopsis of the two reports which I have prepared.
17 It's quite lengthy, but it will take about half an hour,
18 I think, to read it out.

19 THE COMMISSIONER: Go right
20 ahead sir.

21 A Introduction:

22 THE COMMISSIONER: We have
23 lots of time.

24 A The Pointed Mountain
25 Gas Pipeline is a buried ^{hot} gas transmission line extending
26 south from the Pointed Mountain Gas field in the
27 centre of the Northwest Territories, to the Beaver
28 River gas field in Northern British Columbia. The
29 pipeline, 34.1 miles long, and 20 inches in diameter,
30 was built between January and March, 1972, by Westcoast

1 Transmission Company Limited. Approximately 32 miles
2 of the pipeline lie north of the provincial territorial
3 boundary. The southern half of this is the Yukon
4 Territory and the northern half in the Northwest
5 Territories.

6 It is the first pipeline for
7 which specific provisions to rehabilitate the right of
8 way were required under the authority of the Territorial
9 Land Use Regulation. It is of interest to evaluate the
10 effectiveness of the measures as an aid in
11 determining appropriate rehabilitation requirements for
12 future pipeline rights-of-way.

Now, the soils encountered along the route. The soils encountered along the route consist chiefly of greyish-brown to a dark brown clayey, silty till. Other soils include glaciofluvial silt, sand and gravel; glaciolacustrine silt, sand and barbed clay, and alluvial silt, sand and gravel.

1 The latter deposits occur chiefly across the flood
2 plains of LaBiche and Kotaneelee Rivers. Bedrock con-
3 sisting of lower 'Cretaceoussilt stone, sandstone and
4 shale, was encountered along about 6,100 feet of the
5 route. Discontinuous zones of permafrost ranging from
6 10 to 4,300 feet in length, were found chiefly in low,
7 swampy poorly drained areas.

8 Approximately 7,300 linear
9 feet of permafrost was excavated along the pipeline
10 trench.

11 Permafrost, I'll give a brief
12 description of it. Permafrost; prior to construction,
13 consultants to the company and to The Department of
14 Indian and Northern Affairs, reported the presence of
15 sporadic permafrost along the proposed right-of-way.
16 The permafrost areas had been identified by first exam-
17 ining aerial photographs and then checking possible
18 areas in the field by probing with a rod or digging
19 shallow test pits.

20 As there was no drilling done
21 to determine the depth or the extent of the permafrost,
22 results of these investigations were merely to confirm
23 the existence of perennially frozen ground in several
24 areas along the proposed pipeline route.

25 Examination of the material
26 exposed during excavation of the trench provided an
27 excellent opportunity to identify the permafrost areas
28 along the pipeline route. Incidentally, I had the same
29 opportunity when they built the pipeline from Toronto
30 -- from Montreal to Toronto in 1949 and '50, I was

1 working in mapping the soils, and I followed that route
2 through my area.

3 At the same time, the extent
4 and thickness of each area was investigated by drilling
5 holes along the edges of the right-of-way, using a truck
6 mounted power auger. The holes were drilled to the
7 bottom of the permafrost or to a maximum depth of about
8 35 feet. The existence of permafrost was identified by
9 the presence of visible ice, or in some instances, by
10 small icy inclusions which could be seen only with the
11 hand lens. No soil temperatures were taken.

12 Ground water. During excavat-
13 ion of the trench, ground water was found in lenses of
14 sand and sandy gravel scattered throughout the till.
15 Although most of the small streams and swamp areas in
16 the valleys crossed by the trench were completely
17 frozen, so that there was no flow of water into the
18 excavation, varying quantities of ground water were
19 found in alluvial sand, silt and gravel beneath the beds
20 of some of the larger streams.

21 In places, the trench was part-
22 ially filled with water and at one instance, the water
23 overflowed to form an icing across the right-of-way.
24 This overflow of water, incidentally, was from a gravel
25 lens in the till. It wasn't from any stream.

26 The methods of construction
27 involved a continuous series of different operations
28 which commenced at the Beaver River or south end of the
29 pipeline route, and finished at the north end. The
30 only exception to this was the last phase of the final

1 clean-up, which because the construction camp was
2 located at the south end of the route, started at the
3 north end and proceeded southward.

4 The first operation, clearing.
5 This operation consisted of removing from the 80 foot
6 wide right-of-way, all trees, fallen logs, stumps and
7 shrubs and then burning them. Most of the clearing was
8 accomplished by bulldozers, although some hand clearing
9 was done, especially along the margins of the right-of-
10 way. Larger logs were sawn into lengths suitable for
11 piling and burning. There was no timber recovered.

12 Although considerable care was
13 taken to minimize terrain damage during the clearing
14 operation, some damage occurred in areas where the
15 ground surface was hummocky, or where large trees were
16 present.

17 Originally, Westcoast Trans-
18 mission had permission to clear up to a one hundred
19 foot wide right-of-way. Although not definitely stated,
20 it was assumed that the 100 foot limit would hold also
21 for maintenance operations. During the field investi-
22 gation, and that's what I did in June of 1974, it was
23 noted that during its maintenance program, Westcoast
24 had opened a number of borrow pits along the sides of
25 the rights-of-way, and thus effectively increased its
26 width to 2 - 300 feet.

27 Grading. This operation con-
28 sisted essentially of grading slopes by cutting and
29 filling in order that the pipe could be bent and laid
30 properly, and adequate work along the right-of-way could

1 be maintained. Considerable grading was done on the
2 steep south side of Kotaneelee River valley where^a a cut
3 somewhat bigger than 30 feet was excavated, and glaciol-
4 acustrine silty sand at the top of the bluff.
5 Here, the construction method used was standard cut and
6 fill operation, whereby the material excavated from the
7 cut was bulldozed down slope to the toe of the bluff.

8 The depth of the trench on the
9 slope was a standard five feet, but was increased
10 slightly in the fill area. Even with the increased
11 depth, however, there is a section of the pipe at the
12 bottom of the bluff resting on fill, and not on original
13 soil. Grading on the north sides of both LaBiche and
14 Kotaneelee Valleys resulted in cuts up to 20 feet deep
15 along the tops of the slopes.

16 An interesting point here is
17 that as far as could be ascertained, a centre line pro-
18 file along the right-of-way was not prepared prior to
19 construction. Consequently, the quantity of material to
20 be moved in any one locality during the grading
21 operation, seemed to rest with the contractor.

22 The final phase of the grading
23 operation was the construction of a four to five foot
24 snow berm over the proposed trench line. Its purpose
25 was to decrease frost penetration and thus enable the
26 ditching machines to excavate the trench more easily.

27 Hauling and stringing. This
28 operation consisted of hauling the pipe along a winter
29 road from Fort Nelson, B.C. where it had been delivered
30 by railway, and stringing it along the graded right-of-

1 way. The average length of the 20 inch pipe was about
2 57 feet and its weight was about 80 pounds per foot.

3 Bending. An interesting point
4 here is that, although the contract specifications,
5 that is between Westcoast and Marine Pipeline, the
6 contractor, stated that the pipe bend should be laid out
7 to conform to the bottom of the trench, in this operation
8 the pipe was bent before the trench was dug. Deep sags
9 were located and laid out in such a manner that it was
10 necessary in some places to excavate the trench to more
11 than standard depth.

12 Lining up welding and X-ray
13 examination of the welds. The pipe was lined up on
14 wood skids and welded. Subsequently all the welds were
15 examined visually and by X-ray techniques.

16 Trenching. Most of the trenching
17 in both soil and bedrock was done by wheel ditching
18 machines. The common depth of the trench was five feet,
19 with a width varying from 48 to 54 inches. Backhoes
20 were used, sometimes in conjunction with bulldozers
21 equipped with rippers where it was necessary to increase
22 the size of the trench.

23 At some small creek crossings
24 and till areas where the alluvium was relatively thin,
25 the trench was excavated to a depth sufficient to bury
26 the pipe in the underlying till. On the crest of till
27 ridges, the trench was sometimes cut slightly deeper
28 than five feet, to reduce the degree of pipe bending
29 required. In places where water or permafrost was
30 found, backhoes were used to excavate the trench -- a

1 trench wide enough to accommodate the concrete saddle
2 weights specified for these areas.

3 At the same time, any large
4 mass of ground ice visible in the walls or floor of the
5 trench was removed. The hoes were also used to remove
6 large boulders in the till. The trench at the crossing
7 of LaBiche and Kotaneelee Rivers was excavated by drag
8 lines.

9 It was not necessary to drill
10 and blast in order to excavate bedrock. In most cases,
11 the ditching machines removed it. However, in a few
12 localities where the sandstone beds approached six
13 inches in thickness, or more in thickness, it was neces-
14 sary to use bulldozers equipped with rippers to loosen
15 the rock. This same equipment sometimes was used to
16 loosen the frozen surface soil, especially in permafrost
17 areas.

18 Cleaning, taping and lowering
19 in of the pipe. This was a standard operation using
20 standard equipment, and followed as closely behind the
21 trenching operation as possible.

22 Addition of saddleweights.
23 in areas where swamp or permafrost conditions
24 existed, or where excess ground water was encountered.
25 Four thousand pound concrete saddleweights were placed
26 upon the pipe after it had been lowered into the trench.
27 The spacing of the weights range from 25 to 27.5 feet
28 in permafrost, and was 27 feet in swamp areas. The
29 purpose of the weights was to provide negative buoyancy
30 to the buried pipe.

Concrete aggregate for the saddle and river weights was obtained from a gravel bar in LaBiche River, immediately downstream from the pipeline crossing. The mixing plant was set up on the bar, the mixing plant consisted of a ready-mix truck. The material was of a poor quality, having a high silt content and containing numerous large stones, some of which were soft and weathered. Several of the weights first constructed from this aggregate were rejected because of the poor quality of the concrete.

To overcome these deficiencies, the sub-contractor responsible for manufacturing the weights, increased the cement content in the mix and screened out all boulders and clods of material over 4 inches in diameter. Also the fill forms were covered with polyethylene sheeting and heated to decrease the effect of the sub-zero temperatures.

About 1,000 cubic yards of material was excavated from the bar, the top of which was estimated to be from four to five feet above the water in the adjacent river. After completion of this operation, the surface of the bar was smoothed so that no depressions remained in which fish could be trapped.

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1 In an effort to reduce the
2 number of expensive saddleweights I was told they cost
3 something like \$300 each, an unsuccessful attempt was
4 made to install screw anchors and dense clay till.

5 THE COMMISSIONER: Each
6 300?

7 A That's right.

8 Q Oh, I see, I was

9 A And delivering them to
10 the job.

11 Q Just pausing a minute.
12 Excuse me, Mr. Owen, just so I can compare this to the
13 Arctic Gas -- you had some evidence about saddle
14 weights. Were they made of concrete?

15 MR. GENEST: That's right sir.

16 THE COMMISSIONER: Go ahead,
17 sorry.

18 A An unsuccessful attempt
19 was made to install screw anchors in dense clay till
20 exposed in the bottom of the trench at mile 15.5. At
21 this location a gravel lens from which a large amount
22 of ground water was flowing into the trench, was
23 uncovered in the till.

24 The drill used was a truck
25 mounted power auger normally employed to determine the
26 extent of the permafrost areas along the right of
27 way. However, the till was so compact that it was not
28 possible to drill the anchors more than a few inches
29 into it. As a result of the failure of this attempt,
30 the company abandoned this technique.

Backfilling the Trench:

The trench was backfilled with excavated material. This material had been placed on a spoil bank along the side of the trench opposite to that along which the pipe had been lying. At the time of backfilling, the material in the spoil bank was frozen, and commonly was covered with a few inches of snow. The initial backfilling was done carefully, with a small bulldozer so that large clods or stones or clod of frozen material do not fall directly upon the pipe and damage the wrapping.

They also used a crane with a Mormonboard but they only had one crane and one Mormon board and it was pretty hard to do the whole job so they were using a cat and they were using a Mormon board as well.

Once a protective pad of material had been placed upon the pipe, the backfilling was completed. As it was not possible to compact the frozen backfill material, a crown two to three feet in height was constructed over the buried pipe. In sections where there was a high percentage of peat and other organic material in the backfill, a higher crown up to five feet was constructed. Either a crown or a berm, they're the same thing.

Final Tune Up. The final tune up operation followed immediately behind backfilling. This included the felling and burning of all damaged trees along the edge of the right of way, the removal of all refuse, boulders and stumps, the smoothing of the

1 earth along both sides of the trench, the restoration
2 as much as possible of all stream banks, and the
3 sufficient sloping of all side cuts and fills so as to
4 prevent sloughing.

5 Small bull dozers were used
6 in the cleanup to uncover logs and other debris buried
7 in the snow. In the final phase of the clean up
8 operation, the equipment worked north to south along
9 the right of way, opening all stream courses, crossing
10 the right of way, and constructing water breakers or
11 diversion dikes as required.

12 Stream Crossings: There are
13 two major river crossings and approximately 30 smaller
14 stream crossings along the pipeline route. Most of the
15 minor streams were completely frozen during the operation
16 and the crossings were made using normal trenching
17 procedures. Where water was not frozen in some of the
18 larger streams however, the trench was excavated suffic-
19 iently wide and deep to accommodate saddle weights.
20 The two major rivers, easterly flowing La Biche and Kotaneelees
21 which crossed the route, approximately at mile 14.5
22 and 22.4. Here, the river crossings were constructed
23 by excavating a trench beneath the main channel to a
24 maximum depth of approximately 23 feet below the surface
25 of the water and employing heavy wall pipe and river
26 weights to produce negative buoyancy.

27 Throughout the remaining
28 sections of the valley floors of these rivers, the
29 trench was excavated to the normal five foot depth.
30 These included localities where abandoned or intermittent

channels

1 /were present. That's not quite correct. There's one
2 channel, the South Channel of the La Biche where they
3 had to go deeper. I'll explain that in a photograph
4 how they -- in one of my slides how that worked out.

5 The trenches between the main
6 channel of the La Biche and Kotaneelée Rivers were excavated
7 by drag lines. The spoils which consists of alluvial
8 sand and gravel and containing bores 24 inches in
9 diameter as well as considerable organic material, was
10 placed along the upstream side of the trench. Some
11 difficulty was encountered on the La Biche crossing where
12 the spoil bank acted as a dike and diverted water into
13 a former channel of the river south of the main channel
14 and this was where they had to deepen slightly
15 here.

16 This necessitated
17 deepening the trench in this locality. There was no
18 bedrock in the trench excavation at either crossing.
19 The pipe was assembled in one long string pressure
20 tested clean coated, loaded with 40,000 pound concrete
21 river weights and lag. The strings were then pulled
22 into the water and through the trench by a bulldozer
23 located on the far bank.

24 Final Pressure Test. After
25 completion of the backfilling, a final pressure test
26 was made on the completed pipeline. Compressors were
27 set up at the south end and a test pressure of 1688 PSI
28 maintained the line for 24 hours with no pressure drop.
29 This was 1.25 times the maximum operation pressure for
30 which the pipeline was designed.

Grass Seeding and Fertilization.

After the final cleanup, the entire right of way was seeded, and fertilized with a fixed wing aircraft at a rate of approximately 80 pounds of grass seed and 300 pounds of fertilizer per acre.

Now, something about the terrain damage that we noted in our visit in June, 1974.

In June, 1974, some two years after construction of the pipeline was completed, that would be two years, but that would be three breakups, because it would be the breakup of '72, the breakup of '73 and the breakup of '74, so there was actually three breakups there.

In general, terrain damage along the right of way fell into three categories. The first was that which occurred in the course of construction, chiefly during the clearing, grading and trenching operations. The second important factor in causing terrain damage, was subsequent erosion by surface water, which to me is by far the most important, which in places caused sliding on cut slopes along the sides of it and across the right of way. An almost continuous subsidance trench ranging from 6 to 12 inches or more in depth existed over the buried pipe. This was probably due to the lack of consolidation of the frozen ice rich fill placed over the pipe in the winter.

Gulleying by water concentrated in the trench reached depths of five or more

1 feet in some locations. Deep gulleys were also eroded
2 along the courses of streams, flowing across the right of
3 way and in some permafrost areas.

4 Thirdly, considerable damage
5 resulted from the latter movement of equipment belonging
6 to other agencies along the route and also apparently
7 from the rehabilitation efforts of the company.

8 Bull dozers used by the pipeline contractor during
9 clearing and grading operations were not equipped with
10 mushroom shoes or similar attachments commonly employed
11 during seismic operations. The efficiency of the
12 pipeline operation would have been appreciably decreased
13 if the contractor was compelled to use these devices.
14 Unlike in seismic operations, there was considerable
15 light vehicle traffic which required a fairly level
16 roadway along the route During construction. Some
17 terrain damage occurred in hummocky areas or where large
18 stumps were uprooted, but for the most part. the over-
19 lying organic layer was not greatly disturbed.

20 There was, however, considerably
21 less damage along the rights of way of the gathering
22 system at the Pointed Mountain end which were cleared
23 entirely by hand.

24 THE COMMISSIONER. Excuse me
25 sir. The efficiency, you say, the efficiency of the
26 pipeline operations would have been appreciably decreased
27 if the contractor had been compelled to use these
28 devices, that is the mushroom shoes on the blades of the
29 bulldozers, since there was considerable light
30 vehicle traffic that required a fairly level roadway.

1 In other words, they weren't
2 just using the blade, without any device to protect the
3 ground and thus achieved a roadway that was very much
4 more suitable to light vehicle traffic than they would
5 have had if they had used mushroom shoes.

6 A This is true. By light
7 vehicle traffic, I'm referring to welding trucks --

8 Q Pickups.

9 A Pickups, 34 and 36
10 pickups they had on the job and vehicles of this
11 order. Also I guess you would probably get the pipe-
12 hauling trucks. They're not exactly light but still
13 they'd need a fairly level roadway in order to haul,
14 even with that, on the steeper slopes, like up the
15 Kotaneelee and the La Biche they had bulldozers pull them
16 up and then when they got further along they found it
17 wasn't possible to haul the entire length of the route
18 so they went down and came up another road and come
19 in from the other side, from the Pointed Mountain end.
20 But most of the pipe was hauled in to the Beaver River
21 and then up the right of way.

22 In June 1974, terrain conditions
23 along the right-of-way could be described as fair to
24 good. They were certainly not excellent. During the
25 construction phase, it was my opinion that the company
26 was extremely careful not to cause more damage to the
27 terrain than was necessary to construct a safe,
28 dependable pipeline. However, since that time, both
29 seismic and maintenance equipment have moved across
30 and along the line causing considerable damage to the

1 terrain in some permafrost areas. There is evidence
2 that some of this movement took place when the ground
3 surface was not completely frozen. In one area, a
4 corduroy road was constructed along the edge of the
5 right of way to avoid a particularly wet spot. This
6 certainly wasn't done by Westcoast.

7 In the course of their
8 activities both maintenance and seismic exploration
9 crews have damaged breakers, blocked stream channels,
10 by means of temporary crossings and opened up numerous
11 small borrow pits to obtain material for pipeline
12 crossings and for covering the pipe in locations where
13 it had become exposed. It was understood that the
14 seismic operators intend to return to the area to
15 conduct a clean up operation in July, 1974. However, it
16 seems extraordinary that the blocked streams and
17 concreted breakers were not restored during or immediately
18 following the operation. I think in the Land Use
19 Regulations, the seismic people got a permit, it was
20 part of the permit that they would have to open up these
21 streams before they left the job and certainly I'll
22 have pictures to show that they didn't do that. And
23 you couldn't blame this thing onto Westcoast. It was
24 done by someone else.

THE COMMISSIONER:

25 Q What are breakers,
26 . damaged breakers?

1 A A breaker is a ditch
2 designed to carry surface water across the right-of-way
3 to the edge. It's usually on slopes. It's a bulldozed
4 ditch mostly, but on steep slopes they might use sand-
5 bags as well.

6 THE COMMISSIONER: Designed to
7 carry surface water across the right-of-way?

8 A Yes, from the pipeline,
9 from the pipeline ditch. They do not cross, at least
10 they don't cross the pipeline ditch.

11 THE COMMISSIONER: Right,
12 right.

13 A -- they go from the pipe-
14 line ditch. I have several photographs showing the
15 breakers, how effective some were and how diseffective
16 others were.

17 Considerable damage has resulted
18 from the opening of small borrow pits along the edges
19 of the pipeline right-of-way by the seismic operators,
20 to obtain material to construct cross-overs over the
21 buried pipe. Two borrow pits had been opened by West-
22 coast Transmission, immediately west of the right-of-way
23 near mile 333.5 to obtain material for a berm over an
24 exposed section of pipe in the lower swampy area west
25 of Fishermen Lake.

26 The borrow pits are located
27 close to a section of the right-of-way where permafrost
28 was encountered during construction. As far as it is
29 known, no attempt was made to determine the presence of
30 permafrost on the site before these pits were opened.

On the top of the north wall of LaBiche River Valley, a small borrow pit had been opened along the east side of the right-of-way to obtain material for construction of a dyke across the top of the steep slope leading down to the river. With the apparent consent of the Fisheries and Marine Service, Environment Canada, Westcoast Transmission bulldozed some 400 to 500 cubic yards of gravel from a bar on the south channel of the Kotaneelee River to cover an exposed section of the pipe.

Rehabilitation procedures instigated so far by Westcoast in this area, consist of construction of a diversion ditch to carry the water from the streams, and burial of an exposed section of

1 the pipe beneath a berm of material excavated from nearby
2 borrow pits. It is suggested that if these
3 measures are not successful it may be necessary to
4 attach river weights to the pipe.

5 Since construction, consider-
6 able surface water erosion has occurred in the cut at
7 the top of the bluff on the south side of Kotaneelee
8 River Valley. Sand bag breakers installed during con-
9 struction have more or less successfully diverted the
10 water to the sides of the cut, where it had eroded
11 gulleys up to five feet in depth along the toes of the
12 side slopes, thus increasing their instability.

13 Gullying has also occurred on
14 the upstream side of the breakers. Here, Westcoast
15 proposed to regarade the side slopes and to backfill the
16 gulleys along the toes, as well as those along the
17 breakers. TO prevent further erosion sections of half
18 pipe, 20 inches in diameter, were to be installed.
19 Also, the right-of-way, including the cut slopes, were
20 to be fertilized and seeded. These proposals by West-
21 coast to rehabilitate the right-of-way in this area,
22 should go a long way towards alleviating the existing
23 terrain problems, otherwise a continuing maintenance
24 problem will exist.

25 During construction of the
26 Kotaneelee River crossing, the pipe was buried to a
27 maximum depth of 23 feet beneath the surface of the
28 water in what was then the main channel of the river,
29 and about six feet beneath the rest of the valley floor.
30 Since that time, the main flow of water has switched to

1 the south channel of the river, and subsequent scour
2 exposed the pipe beneath that channel.

3 As described previously, a
4 gravel berm has since been constructed over the exposed
5 section, however, at the time the crossing was visited,
6 it was evident that the berm was not a permanent
7 solution, as active erosion by river water was occurring.
8 To avoid a continuing maintenance problem the pipe
9 should be reburied to a greater depth across the entire
10 area where the active channels exist.

11 At the LaBiche River Valley,
12 minor sliding has occurred on the upper part of the
13 steep bluff forming the south wall of the valley. The
14 material is silty clay till. Bedrock consisting of
15 highly weathered imbedded shale and sandstone, overlain
16 by a small terrace of glacial fluvial gravel, was
17 encountered in the pipe trench at the toe of the bluff
18 during construction. There has been no sliding in these
19 materials.

20 Remedial work done on this
21 bluff since construction apparently had consisted of
22 bulldozing material into a small dyke along the brow of
23 the bluff. The purpose of the dyke was to divert sur-
24 face water to the sides of the right-of-way. That's
25 just another big breaker. This measure was only part-
26 ially successfully, as some of the dyke material was
27 sliding down the right-of-way. It is suggested that
28 rather than adding material to the slope, it should be
29 cut back to decrease the grade and that sand bag
breakers be constructed, at least on the upper two-thirds

1 of the bluff. The cut slopes are on the sides of the
2 right-of-way, and the right-of-way itself could then
3 be seeded and fertilized.

4 The limits of the larger areas
5 of permafrost terrain encountered during construction
6 of the pipeline, were plainly marked by visible signs
7 along the right-of-way. However, even without the
8 markers, these areas could be identified without diffi-
9 culty during the visit. Permafrost occurred in the low,
10 swampy poorly drained localities, and is usually covered
11 with a dense growth of small black spruce.

12 During construction, it was
13 found that it was extremely difficult to excavate the
14 pipe trench in ice-rich permafrost as the ditching
15 machines tend to climb, making it difficult for the
16 operator to maintain the proper grade for the floor of
17 the trench. In most permafrost areas, therefore, the
18 pipe trench had to be excavated with backhoes or bull-
19 dozers' equipped with rippers.

20 The width of the trench had to
21 be increased to accommodate the saddle weights placed
22 on the pipe in all permafrost areas. As a consequence
23 of the greater movement of excavation equipment in the
24 vicinity of the trench, the permafrost areas, consider-
25 ably more terrain degradation has occurred than in other
26 areas.

27 Possible thermokarst features
28 consisting of rectangular shallow water filled depress-
29 ions up to three feet in depth and ten feet in diameter,
30 are present in localities, but are not common.

E.B. Owen
In Chief

1 Most occur within about 40 feet of the buried pipe.

2 Thermokarst has not developed
3 in any permafrost area along the right-of-way, in
4 places where timber had been piled and burned during
5 the clearing operation. This was a point that we were
6 working on with the Mackenzie Highway, that they were
7 afraid there would be some degradation of permafrost
8 if they piled the material up and burned it, but it
9 didn't show at all here. Consequently, it can be
10 assumed that the burning of the debris had little effect
11 on the underlying perennially frozen ground. In
12 localities where the trench crossed the site of a
13 former fire, that is where they burned debris, the
14 original layer of the organic material had been burned
15 away and replaced with up to three feet of ashes and
16 charred wood.

17 Now, something about the
18 Pointed Mountain Gas gathering system. The Pointed
19 Mountain Gas gathering system consists of lines of
20 eight and ten inch diameter pipe, which conduct the
21 gas from the wellheads located in the Franklin Mountains
22 some four to six miles northwest of Fishermen Lake,
23 to a dehydration plant about three-quarters of a mile
24 northwest of the lake. The construction of these two
25 utilities, that is the dehydration plant and the gather-
26 ing system, was carried out at the same time as that
27 of the 20 inch trunk pipeline.

28 The methods used in construct-
29 ion of the gathering system depended upon the terrain,
30 the soils encountered along the various routes and the

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In Chief

1 presence of sporadic permafrost underlying the low,
2 swampy area close to Fishermen Lake.

3 On the steep slopes in the
4 mountains, where the material consists of fine-grained
5 thin bedded sandstone overladen with varying thickness of
6 fine talus mixed with poorly graded gravel, the pipes
7 were buried. In the flat areas near Fishermen Lake,
8 underlain by alluvium or by glaciolacustrine silt and
9 clay, they were set on wooden piles, 10 to 12 inches
10 in diameter, which had been driven into previously
11 drilled pilot holes.

12 The depths of the pilot holes
13 depended upon the material encountered. In permafrost
14 areas, where the frozen ground varied from 15 to 30
15 feet in thickness, the pilot holes were drilled to the
16 bottom of the permafrost. Following this, steel cradles
17 were set on the piles which had been cut off about 18
18 inches above ground surface, and the pipe placed on the
19 cradles.

20 Hand clearing the rights-of-
21 way for the gathering system pipelines resulted in
22 relatively little damage to the terrain. There was
23 no noticeable thermokarst subsidence in the permafrost
24 areas. Erosion by surface water on the steeper slopes
25 is negligible. The latter is due to the construction
26 of numerous breakers, which has effectively deferred
27 the water from the sides of the right-of-way and away
28 from the buried pipe.

29 That's the end, sir.

30 THE COMMISSIONER: Thank you

E.B. Owen
In Chief

1 very much.

2 MR. GOUDGE: I take it, Mr.
3 Owen, you have some slides which you would like to
4 show us now and comment upon them?

5 A This is a general map
6 showing the location of the pipeline route to the south.
7 This is the pipeline route here, the dotted line. It
8 starts off, Fishermen's Lake is right here. The gas
9 gathering system is up in this area. The gathering
10 pipes come down to the dehydration plant in here, and
11 following this route down through the Northwest Terri-
12 tories to the Yukon Border, through what we call the
13 Yukon Panhandle, crosses into British Columbia right
14 here. Beaver River is down here, and then of course,
15 from then on it heads -- the gas heads for Fort
16 Nelson.

17 THE COMMISSIONER: I have been
18 to this Pointed Mountain thing. What's that -- that's
19 the Fishermen Lake on the right. What's that on the
20 left, with the blue dots surrounding it?

21 A Oh, this is the southern
22 end of the Franklin Mountains. Actually the gas wells
23 are up here. There's one right on the top of Pointed
24 Mountain, and there's one in the valley right down
25 below it.

26 THE COMMISSIONER: Yes.

27 A But this is the southern
28 limit of the Franklin Mountains. This red line here is
29 the eastern boundary of the Canadian Cordillera
30 Canadian Cordillera being that area of mountains

E.B. Owen
In Chief

1 from this point right over to the Pacific Coast, also
2 extending from the Arctic down to the international
3 border. This is Fort Liard right here, this is the
4 Liard River, and this is the Nelson River coming in
5 here. The LaBiche River, the Kotaneelee River, those
6 -- both originating in this Liard plateau, which is, as
7 I mentioned in my written part, roughly 4,500 feet
8 maximum elevation. A series of high, flat topped mount-
9 ains with wide, rolling valleys, and these rivers all
10 originate in these valleys.
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1 This is the interior
2 plains, very flat of course. -- much different to the
3 cordillera to the west. I guess that's all, the next
4 one please.

5 Okay, let's start in on the
6 job itself. This is a shot showing the clearing
7 operation. You'll notice certainly they've got right
8 down in the mineral soil here, the organic is completely
9 stripped off. You'll notice the cat : -- it's not just
10 a straight bulldozer but it's got -- the only part that
11 is protected is the rad the rest is a rake with
12 tongs down below. It scrapes up the wood and
13 piles it up comme ca. Now this was not all broken
14 up by the dozer. The boys here had power saws, larger
15 trees they would take down with the power saws, and
16 saw them up into lengths which the dozer could push
17 up. The smaller trees and the roots were lifted by the
18 bulldozer and pushed up into these piles.

19 The width of the right of
20 way is approximately 80 feet. You can't see it very
21 well but from here over to the other side would be
22 approximately 80 feet.

23 Here's the next shot.

24 We've actually been burning here. We're looking
25 actually now, we're looking south and you see the burning
26 is going on. The clearing now is pretty well complete
27 across here and they're just burning up little bits of
28 rubble.

29 Anyhow, these are remnants
30 of fires, they're still throwing in bits of wood but in

1 most cases the pipeline route, the right-of-way is
2 pretty well cleared here.

3 Now, the pipeline route is
4 cleared, we have a berm on this side, you can see the
5 organic material, although this isn't always like
6 that, in some instance, there is still organic was on
7 top. This is the berm over where they propose to
8 build ~~the pipe~~ construct a trench. That will be pushed
9 off by a bulldozer and the pipe trench will be built.
10 The idea behind it of course, is to prevent frost
11 penetration. It was very clod up there and as far as
12 watching the thermometer, minus 8 degrees Fahrenheit
13 was the warmest it ever got. It was often down to
14 minus 30 and minus 40, in the morning early. So this
15 was quite necessary, and it was quite effective too.
16 So they got roughly 80 feet across here and we're
17 all set for the pipe to come in.

18 Okay, now the pipe has come
19 in, it's hauled in by truck along this haulage way and
20 this is why they need a nice and smooth. They couldn't
21 possibly haul heavy pipe unless they had a bulldozer
22 with every truck.

23 Now the pipe is strung along
24 the berm, the same shot as the previous one, except
25 now you've got the pipe sitting on skids here.

26 All right, now, the next step,
27 the pipe has been welded, I wasn't too interested in
28 the welding, because actually to an engineering
29 geologist, the welding is just another job, but this
30 shows what happened. The pipe has been welded, and it's

1 been bent but they still haven't got the trench in.
2 We're looking -- in this case we're looking north, and
3 in all instances the haulage road was along this side
4 to the east side of the route. It's on skids, we're
5 still 80 feet, you can see this is the stuff that came
6 off, off the right of way was cleared right of way.

7 Now we've got a ditching
8 machine in operation. He's in--- that trench
9 is roughly five feet, it's roughly 48 inches, they had
10 three ditching machines and I understand I was told,
11 that one'dug a 38 inch ditch wide, one drilled a
12 50 and one did a 52. I don't know why they had four,
13 but three of different sizes, this is the way it went.

14 Pipes lying here on skids
15 ready to go. The ditch is being constructed. There
16 were three ditching machines working, I think they
17 had five or six backhoes as well.

18 Okay, now we're up close.
19 This is till, there's the frost line right there, this
20 is not in permafrost, there's the frost line. Above the
21 frost line we see the ditching machine has actually
22 sheared the pebbles off. All these white spots are
23 the ends of pebbles, which the machine has actually
24 taken off. Down here it was not frozen.

25 This is a big boulder that
26 fell out, when boulders like that fall out, and there
27 were a lot of boulders in that till. especially on the
28 lower parts of some of the knolls and also on the very
29 crest. When those boulders fell out, the ditching
30 machine of course couldn't handle them. They dropped to

1 the bottom and they had a clam for -- a crane with a
2 clam. Well actually, it's like an orange peel, four prongs
3 and it would come over and lift the boulders up and
4 drop it in behind the spoil bank.

5 A rather interesting thing here
6 is that I was sampling this material and I found that
7 unless I got in there within about two hours after
8 that material was exposed, I couldn't get a sample
9 very easily because using my knife, I found out that
10 the freeze back, that is the freezing into the
11 soil was about one inch an hour. So if I wasn't in there
12 by about two hours after that was exposed, I had one
13 heck of a time digging it out to get a decent sample.
14 That was just a little experiment I conducted on my
15 own. It wasn't anything to do with the theoreticians
16 and the universities.

17 Now this is another problem
18 we faced. Now I was mapping the soil, I was mapping
19 on an aerial mosaic which Westcoast Transmission
20 very kindly gave me on a scale of a thousand feet to
21 the inch and consequently I got down into this hole,
22 every 300 feet, and examined the material. Now, where
23 the soil was not frozen, in the very cold air, you got
24 this condensation coming off, and I could be within
25 100 feet, down in the ditch, 100 feet from that machine
26 and I couldn't see it, for the fog. You would come out
27 of the hole and you were completely covered with
28 frost. Just your eyes and my moustache and parka
29 and everything else was really cold. But he is now
30 climbing up there. That's just about the steepest

1 grade that that machine can work. I think in a couple of
2 instances they actually put a cat on it and deadmanned
3 the thing, it went up on the winch of the cat.

4 This is actually till.

5 This is a sort of drumlinoidal features that we have
6 over much of the south part of the route.

7 Okay, now there were some
8 spots, in between these two ridges, where there was
9 a small creek or was very wet. They found the ditching
10 machines, they couldn't handle it at all it was too
11 soft, and so they brought in two hoes, and they started
12 in the middle and they backed up, you can see the line
13 stakes in here. They would put the stuff on and dig
14 the trench. In most cases where there was going to
15 be weights put in and wherever they hit water, they had
16 weights almost invariably. Of course the ditch had
17 to be oh, about five feet wide or six feet wide in order
18 to get the weights down into the hole, on top of the
19 pipe.

20 So wherever there was soft
21 spots, they switched to these backhoes, now they had
22 six all together, and excavated these low spots.

23 Here's a spot, this is not
24 where a creek was but we had -- in this particular
25 instance there was quite an extensive lens of gravel and
26 sand in the till which made water. And as soon as
27 the water started to come out of the material, the
28 company immediately started to put in weights. I didn't
29 always think it was necessary because in most cases
30 those lenses were drained in about two hours. It would

1 only be about two hours and they would be froze up
2 tight. Whether they were drained or whether the
3 frost just stopped the water from seeping out, I don't
4 know, but wherever there was wet, they had these
5 weights in and these are saddle weights with 27 foot
6 centres.

7 Now here's a case, they
8 thought they'd try these anchors so as I mentioned in my
9 paper, they brought in the truck. this is the truck
10 they used later on for looking for permafrost, and
11 extended permafrost and they tried to put these anchors
12 into the till, but there was no way. They got down
13 a matter of three or four inches and they just bogged
14 down. That till is extremely dense, hard stony and
15 there was no way.

16 An interesting thing here,
17 after all the pipe had been wrapped, cleaned and
18 wrapped and sitting in the ditch all ready to be buried.
19 there's a chap standing on it, and I questioned him.
20 I asked them just why after all the carefullness of
21 wrapping that pipe and getting it all nicely set up why
22 they would stand on it. He said well it was common,
23 they did that all the time and that gum rubbers
24 wouldn't hurt the wrapping. Well I had to take his
25 word for it, but it did seem that after all the care
26 they'd taken, that they would be more careful with the
27 wrapping.

28 Now this is the only spot
29 where I actually saw an icing where in the till. they
30 had encountered a gravel lens, it weighed the thing down,

1 it weighed the pipe down, and buried it and yet there
2 was sufficient water in that gravel lens to come up
3 to the surface above the pipe and flow out over the
4 load. Actually towards the end that was right across
5 and they had a grader working here to take the ice
6 off. But this is something that has been quite
7 common along the Alaska and the highways of the Yukon
8 and you can see there is, it's not really open water
9 there, but it's mighty close to it. That is
10 actually ground water that has come up through a sand
11 and gravel lens, it was quite an extensive lens, it
12 was about 400 feet long, and at the time the pipe was
13 buried and of course, in one instance, the pipe did
14 have ice on it, the trench was partially filled with
15 water.

16 Here we are, we're going up
17 into the rock. This is a rock slope here that was
18 completely excavated by bulldozer, rippers, D-9 cats
19 pushed over here, and when the machine, the ditching
20 machine started up, there was no way that he was going
21 to cut through that rock so they went to the hoes and
22 the hoes were taken up there. You see the nice
23 stable slope of the bedrock, no trouble there at all,
24 but there's just no way that the ditching machine could
25 excavate that trench in the bedrock.

26 Another spot, now this is
27 actually on the north side of the LaBiche River. We've
28 left the river, we're going up the north side of the
29 LaBiche River Valley, and what we have here, this
30 is bedrock here. This is the only other spot they hit

1 bedrock on the line. We have bedrock in here which
2 the dozers took out, once again, it wasn't possible to
3 take it out with the -- take it out across the ditch
4 so they went to the hoes again, and the backhoe came
5 right back along this line to the river.

6 Up here, this looks like
7 a trenching job but I feel sure they had a hoe in there
8 too, because it's not quite regular enough. We had,
9 just above the bedrock, we had a gravel terrace, no
10 water in it and above the gravel, we had till to the
11 top and I'll show you pictures we took two years later.
12 There's quite a lot of river erosion and the water
13 was surface water erosion along that bluff.

E. B. Owen
In Chief

1 I took this picture pri-
2 marily because at one time in the House of Commons, a
3 Member got up and questioned the fact that anybody
4 needed an 80 foot right-of-way to bury a 20 inch pipe.
5 He couldn't visualize why they would need such a tremend-
6 ous swath of ground to put in a little, teeny weeny pipe.
7 Well, it's pretty obvious to me that they have got the
8 berms on each side, and the graders coming by pushing
9 snow all the time. Then they have the ditch with the
10 spoil bank on the far side, and then I think you have
11 to have -- correct me on this, but there is a minimum
12 distance from the edge of the trench to where the pipe
13 is. I think it's eight or ten feet. That's the law,
14 I don't know where it comes from, but that's the law.
15 And then we have the welding machines, which of course
16 you have got your side boom tractors as well. You
17 have your haul road for your pick-ups and what-have-you,
18 and then off here on one side in the bush is a bus
19 where the men could go and get warm and eat their
20 lunches.

21 So actually 80 feet wasn't too
22 big. I know many times I would be driving along there
23 and I couldn't get by because there was a couple of
24 welding trucks or something in the way, and you would
25 just have to wait until they moved on.

26 This is a general view of the
27 job. You see the undulating terrain, about 80 feet
28 again, and when the pipe was welded, they left open
29 these here, so the equipment could move back and forth,
30 because once that pipe was welded, of course, it blocked

1 anything from moving from the haul road over onto the
2 trench lines.

3 This is looking now on the north
4 end of the job.

5 This was coming down through
6 one of the archaeology sites into Fishermen Lake. Fish-
7 ermen Lake over here, there was an old former lake
8 basin that cut around and back the other side of Fisher-
9 men's Lake, and the emerged beaches were where the
10 archaeologists were looking for artifacts, and the day
11 I took this picture, I had a young archaeologist with
12 me in my truck. I took him out and I dropped him off
13 here. He took one look at all that equipment and just
14 shook his head. He didn't see how he would find any
15 artifacts in that.

16 But at any rate, they are moving
17 down now, and this is the upper beach, and it's in this
18 general area here that they expected to find artifacts.
19 It always amazed me at this beach, right around the edge
20 of this lake, was six miles long, and yet the archaeolo-
21 gists had to work in that 80 foot strata. I just
22 couldn't see why they couldn't use the other 5.99 miles
23 of beach to find the same stuff. But this is where
24 they worked. I think it was because it was accessible.

25 Okay, now we are going through
26 -- around the edge of Fishermen's Lake, and this is
27 a water filled trench. This is the trench in which they
28 placed the pipe, and this was taken out by backhoes.
29 There was no way that ditching machines could get in
30 there because the ground was extremely soft, and the

Coming out from the other end, that last shot was in about here somewhere. Coming out, we are now looking south. Once again, we have got archaeology sites. You can see the bends in the pipe gives you some idea how it's coming up. Here are the weights which they used. They were strung along here because the pipe isn't in.

Well this is just a geological shot. We have about two feet of silt over barbed clay, over till. This was taken up near the dehydration plant, and actually artifacts that the archaeologists were finding were just on the top of the silt, in the organic layer in the silt, and a couple of inches into the silt. IF they didn't find any silt, they didn't seem to be too interested in looking for artifacts.

During the final clean-up, we used these fire sleds which I thought were a darn handy rig. A small bulldozer just pulled them along. The people here were throwing logs in, what they couldn't -- what needed to be sawed up, they just threw them in. The bulldozer moving along, the ashes shake out the bottom. You see the -- when the cat

1 wasn't pulling the fire sleds, he was off rooting out
2 out debris, the same sort of a blade that he had on the
3 first clean-up, or the first clearing operation. A
4 very handy rig, I don't know why it's -- somebody hasn't
5 patented it. These were actually --one of these was
6 made by Westcoast in their shop and someone told me it
7 only cost them \$300.00, it was all made from scrap.
8 Maybe someone can confirm that, I don't know. But it's
9 just three inch pipe welded, and a heavy gauge screen
10 put around it. IT's all the same, they just kept her
11 going.

12 This is the south end of the
13 line. The Beaver River dehydration plant is over here,
14 of course the 20 inch line from Pointed Mountain bypassed
15 it, came around the end of it. This is the line going
16 to Fort Nelson, the 24 inch line. This pipe will be
17 hooked up to a valve right there, and that is the piece
18 that will go in here. That's in till, it has not been
19 yet, of course it is all wrapped, but it hasn't
20 yet been covered. In this instance I was there when
21 a small, about a D6 cat came along, very carefully push-
22 ing this stuff over onto the pipe, very carefully, and
23 after he got about a foot of material that he just
24 went and just filled her up.

25 Of course this -- I'm sorry.
26 This is the valve, 24 inch pipe headed for Fort Nelson.
27 This is all ready for the one to come in here that we
28 are going to hook up with.

29 Now, the week before I took this
30 picture, I had with me in my truck, the inspector from

1 the National Energy Board, and I was to take him along
2 the line, and the first thing that he said, "Let's
3 start at the downstream line and work up", so we drove
4 in here and he said -- looked at this thing and
5 expletive deleted, he said, "Let's get out of here".
6 I said "What's wrong?" He said, "Well", he said, "You
7 don't see anything wrong"? I said "No sir, I see
8 nothing wrong". He says "There's no cap on the end of
9 that pipe, and I said "Well that's right, should there
10 be one?", and he said, "There certainly should", so we
11 checked later, and evidently what had happened, West-
12 coast had come in and taken the cap off, in order to
13 see if the threads or whatever it is they use on the
14 end of it was going to be okay for welding, and then
15 they had forgotten to put it back on.

16 The funny part of it was that
17 the great big wheel that goes around that valve, 70
18 open it up was in the back of my truck. I didn't
19 know it until I got back that night. But this is one
20 of these things that happen.

21 Now, here's a permafrost area.
22 This is the area just north of the Kotaneelee about a
23 mile. We had an old glacial lake that extended in here,
24 and went back out the other side, and then went around
25 that ridge in the Pointed Mountain, and evidently they
26 ran out of weights because there are spots here where
27 the pipe is still exposed, and there's no weights on
28 it. This drill over here is actually drilling to deter-
29 mine the extent of the permafrost. That was part of
30 the -- I don't know if you would call it the permit or

1 the agreement that Westcoast was to determine the extent
2 of all permafrost they encountered along the right-of-
3 way, so this drill was brought in and we would find the
4 permafrost along here and he would drill out on the
5 other side, and I spent quite a lot of time watching it
6 to make sure that I could see the permafrost.

7 A close-up of the drill, just
8 a power auger. They would get down there, oh they would
9 get down quite fast, but he could put down a 30 foot
10 hole in an hour, and we were able to get the limits of
11 the permafrost fairly accurately.

12 In this case we are in the
13 permafrost, and this is once again in that area I had in
14 a previous shot. This ditching machine had been working,
15 and he had about 200 feet, he was in the permafrost for
16 about 200 feet. It was a silty sand, extremely hard,
17 and I talked to the operator and he said "there's no
18 way that I can keep that machine down to grade".

19 He pulled off before he moved on, he replaced all
20 his teeth. He is starting to do that now, and you can
21 see little bits of ice through here, and I'll show you
22 a picture or a close-up after it, but that machine,
23 there was just no way that he could handle that parti-
24 cular type of material when it was frozen.

25 Okay, here's a shot, a better
26 one. Actually these white spots are lenses of ice in
27 the silt, in the sand, and yet that is the active layer.
28 Now I'm a practical field man, I don't know why we get
29 ice like that in the active layer, but down here we
30 don't seem to get it, but this was really frozen. You

1 could take a pick and whack that like all heck and there
2 was no way that you could get more than just little
3 chunks out of it, 'and anyhow, that's the sort of stuff
4 that he ended up in.

1 Okay, now in some
2 spots, the berm they put over the ditch excavation
3 wasn't too effective and the frost penetration was
4 quite severe so they had to use a ripper. This is a
5 D-9 cat, there's a ripper on the back and it looks
6 like an 8 pushing and we have extreme difficulty
7 in even getting that tooth started. In this particular
8 instance, he was trying to get it down in, had
9 difficulty, that hoe came up, he put the blade down
10 and a bucket and a hoe down there he pushed. he couldn't
11 make it go, and the hoe went back and he
12 hammered it I never saw it happen before,
13 but he actually got that thing started. I was standing
14 over here with the supervisor, and the supervisor said
15 to me, something's got to go and we had this cat
16 pulling this and pushing and finally it broke and the
17 tooth didn't break, the soil broke and he was away.
18 This was the sort of stuff he got into. That's
19 permanently frozen sandy silt and you can see it. It
20 doesn't come out loosely, it comes out in
21 slabs and of course this was all weighed. They put
22 weights in all the way along there. But, that's the
23 sort of stuff they had the trouble with.

24 Permafrost. This is perma-
25 frost and till actually, and the ditching machine
26 had started and once again, they had to quit, but you
27 can see the teeth marks here. You can see the ice,
28 and down at the bottom, actually it's just this ice
29 carries right down the bottom, I was taking a picture
30 looking down because it was quite dark and hard to get

1 a decent picture.

2 This is another -- that
3 shovel is roughly 18 inches, that's a chunk of mass
4 mass of ice in the till. Now, I hope you remember this
5 picture because I'm going to show you later what happened
6 two years from now at this very spot. or within about
7 five feet.

8 THE COMMISSIONER: Well,
9 excuse me where is this, this is in the ditch?

10 A This is in the ditch,
11 yes,

12 Q How far below the
13 surface of the ditch are we?

14 A This is one of these
15 spots in the permafrost where they actually went down
16 and tried to take out as much of the ice as they could.
17 Now, as I understand it, the Westcoast job; I can be
18 corrected on this, was to take out as much ice as they
19 could from the ditch, depending on the equipment
20 available. Now, a quarter yard back, and we'll reach
21 down about 13 feet, vertically, but there's no way
22 that a backhoe can go down and hit that ice, because
23 he has nothing to work with, he has to have some movement.

24 This was about eight feet down, this particular
25 instance down here and the surface is up here, so I
26 would say roughly there would be from four to seven
27 feet, that was --

28 This is the LaBiche Crossing
29 we're looking down, two drag lines start in the middle,
30 work back towards the side. the river is flowing from

1 right to left, the spoil bank is on this side. The
2 pipe is strung but not welded, of course, the river
3 crossings were constructed, ahead of the main ditch,
4 so the berm is still over the pipeline right of way.
5 And the pipeline -- where the trench would be dug,

6 Up closer, actually there's
7 the pipes being welded and pre-tested, and to be put
8 in here. The drag lines are pretty well almost finished
9 now, the spoil bank is over here. That spoil bank
10 acted as a dam and diverted the water around in the edge
11 in this particular one.

12 This is the Kotaneelee
13 Crossing. Not taken from there but taken from the
14 top of the bluff. There's the ditch that has been
15 built, there's the access road, the right of way here
16 and the right of way coming up this way. Notice the
17 terrific slides in here. I never got a chance to get
18 up and take a look at that, but to me, it looks like
19 bedrock but there was certainly no bedrock in this
20 excavation through here.

21 Here we are. we're hauling the
22 pipe through the Kotaneelee, it's wrapped, lagged already
23 to go, and there's a cat on the other side, he's pulling
24 it through, it just goes right down through the trench,
25 which was previously dug and end up, we have an end
26 that's coming out of here, tie it onto that end, and
27 it will be welded. It's just being walked along through
28 the river.

29 This is looking the other
30 way. The cat actually got a bit ahead of the side booms

1 here but he's pulling the pipe this way. And the side
2 booms are just walking the pipe right across the river.

3 This is the concrete. This
4 is what I thought was horrible. All these chunks of
5 silt and what not were all thrown in, first of all a
6 gravel bar, a front end loader pushed it up, the con-
7 tractor had steam jets, to keep it more or less --

8 You can't hear me? I'll yell.

9 Okay, this is material taken
10 out of a sand bar, or a gravel bar in the LaBiche River
11 for which the concrete aggregate was obtained for
12 making the concrete weights. And these are -- it's just
13 pit run you might say stuff, clods of silt, frozen,
14 'organic material, all sorts of debris in it and after
15 it was stockpiled, it was hauled over here, kept more
16 or less unconsolidated by steam jets, it was all over
17 here, dumped through that grizzley into the hopper
18 which and where the cement was added, up that belt
19 into a little mix truck, the little mix truck would
20 move over to the forms which were just off to the right
21 of the picture and fill the forms. It wasn't exactly
22 the best way of making concrete, by any means. Later
23 on they found that they brought in material from Port
24 Nelson which was better actually but it wasn't a very
25 good system.

26 This is what I mean.

27 These are -- I had one comment, one chap said the only
28 thing holding that together is the frost. Well it's
29 not quite that bad, These are shadow weights and if
30 there had been any sort of compaction, if they had had

1 somebody up when that stuff was dumped into the form with
2 a two by four, you just pushed it down, it would have
3 worked a lot better. But, at any rate, it wasn't good
4 and this was the original material they were using.
5 Now a funny thing, from what I can make out, there was
6 no effort made by Westcoast to find any good granual
7 aggregate before the job was started. Maybe they did
8 but I couldn't find out. I talked to the contractor
9 who was making these weights and he told me that he
10 was the one who decided to build his little plant there,
11 primarily because it was roughly halfway along the
12 job and he could haul both ways. It would be cheaper
13 to make a road on the job than off in some pit somewhere
14 else.

15 These are river weights, the
16 same problem. Frost forming in the gutter. And a lot
17 of them are rejected, but I'll show the next one. In order
18 to overcome it the contractor, the sub contractor, he
19 actually put the forms in polyethelene sheeting, put
20 salamander heaters at each end, and kept it relatively
21 warm for three or four days until the concrete at least
22 partially cured, but^{if}/it wasn't for that there was no
23 way in my mind, those weights could have lasted. I don't
24 think that concrete had any durability whatsoever.

25 Now here we are up in the
26 gathering system. This is one of the rights-of-way for
27 the gathering system. That was entirely hand cleared.
28 There was no machinery in there whatsoever. All these
29 logs, all those logs are cut by chain saw, they're piled
30 up and they're burned. Just by straight manpower.

1 The same sort of thing, they
2 are all sawed up, ready to be burned. You see there is
3 no sign of equipment whatsoever.

4 Okay. Now we are up on the top
5 of Pointed Mountain, looking down from that one well on
6 top, and this is what the right-of-way looked like just
7 after they started to clear it. The pipe is buried in
8 this. The well is just behind us here and down over
9 the hill. The next one, please.

10 Just over the brow of the hill,
11 you see this is the sort of material, it wasn't very
12 good. To me it was it was a pretty good set up
13 all in all.

14 Now coming down on the bottom,
15 we're coming across that low, flat area near Fishermen's
16 Lake where there is discontinuous permafrost, inter-
17 mittent permafrost, and in this case they drill these
18 pile of holes down, drill these timbers into the pilot
19 holes, and next one please.

20 They shear the timbers off,
21 put the cradles on it, weld the pipe and drop the pipe
22 on top of the cradles and then they had a little clamp
23 which they put over there. That's the way they do it.
24 Okay, now let's get on to terrain damage.

25 This is my favourite, I like
26 this sort of thing. This is probably -- this is a good
27 shot of what the normal Westcoast Pointed Mountain line
28 looks like. I think that's darn good, the revegetation
29 is taken up, you get a small, very small subsidance
30 trench over the pipe. The pipe is right beneath here.

1 It's 80 feet wide, there's no debris, good grass growth,
2 everything looks fine. Let's have the next one.

3 However, in some instances we
4 start getting a little deeper subsidence trench, surface
5 water starts to drain in. Next one.

6 It starts to get a bit deeper,
7 there's been a little stream flowing along here. Now
8 we have reached a point where this breaker which was
9 constructed to divert water away from the pipeline, has
10 now -- the bottom of the breaker is lower than the pipe-
11 line or this trench, so the breaker is now carrying
12 water in, instead of out. In other words, instead of
13 diverting water onto the sides of the right-of-way,
14 the breaker is now bringing water into the pipeline,
15 so that increases the amount of surface water erosion.
16 The next one.

17 We are getting more now. Here
18 we are, there is actually a little stream flowing along.
19 This is still right over the pipe, right over the pipe.

20 Same thing, my shovel there.
21 We are down now, it's getting pretty deep, heading for
22 a creek right in there. Okay.

23 Here's what it looks like, we
24 are getting down close to the creeek. The pipe is some-
25 where underneath there. Next one.

26 Here we are, we are not too far
27 from the creek, it's roughly five feet, this is right
28 over the pipe. Let's have the next one.

29 There you are, there's the
30 pipe, and that's the way it goes. You will find that

1 in two or three places, where according to the permit
2 that Westcoast has, they're supposed to keep that pipe
3 covered at all times. Okay, let's go on to the next
4 one.

5 Here's a stream, now another
6 thing they were supposed to do, they were supposed to
7 channel these streams, keep them in proper shape. This
8 stream comes across to here, this is the right-of-way,
9 looks good up there. Here's the stream comes across
10 here, cuts across the pipe, comes back and follows along
11 it. That stream was never channelled, no way. Okay,
12 next one.

13 Here's another stream, the
14 same idea. The young lady is standing, the pipe is
15 actually coming through here, like that, and you can't
16 see it. I can't tell you whether the company has
17 records of the pipe depth, the width they bury the pipe
18 beneath each stream, but I couldn't tell you that. I
19 would assume it's around between five or six feet, but
20 that creek is following right across the pipeline, and
21 there's been no -- I don't think there was any effort
22 really to channel that thing.

23 Okay, next one. Here's
24 another one. It was slightly channelled, but it started
25 to run wild. There's the pipeline berm, the pipe is
26 down in here somewhere. Now what intrigues me is I'll
27 show you the next one, is the fact that this is a
28 stream that's been channelled, but the channel wasn't
29 big enough. You can see how the water, the boulders
30 have gone way up over here. Well, I would like to have

1 somebody tell me what happens if one of these boulders
2 hits the wrapping on the pipe. The pipe is just down
3 in here somewhere; not too deep, and that stream is way
4 up, at least 50, 75 feet away from the -- I mean that's
5 a terrific flood, but it was recognized definitely when
6 they put the pipeline in that that stream had to be
7 channelled, but it wasn't by any means wide enough.

8 Okay. Well this is another spot
9 where the pipe was exposed by a stream, and it was
10 exposed sufficiently big that the pipe was actually
11 acting as a dam for debris which the stream has -- is
12 flowing. This log evidently came down somewhere, I'm
13 not sure from where, but the stream is flowing that way,
14 and here we got the pipe and you can see the material
15 flowing -- piled right up against it. I've got another
16 shot from a different angle on that one. Okay.
17 Not a very good one, but there it is again.

18 The stream is flowing, and
19 that material is just piled up against the pipe. Okay.

20 Now, this is the famous pipe
21 that rose in the ditch at Pointed Mountain. I didn't
22 take this picture. It was taken by one of the Indian
23 Affairs' people and they gave it to me with great glee,
24 so I am producing it to give you some idea what
25 happened. Evidently something went wrong, as I under-
26 stand it, with the pressure -- not the pressure, but
27 the temperature of the gas in that pipe, and it caused
28 it to expand and rise.

29 Now, I may be incorrect on
30 this, I don't know, but when Dr. Williams was talking a

1 while ago, he mentioned -- he was talking about one-
2 thousandth of an inch rise or fall in the pipe. That
3 thing has come up about five feet, and that's just
4 another pipe, I mean no one seems to worry about it too
5 much.

6 Some pipeline engineer, I
7 would like to talk to, to find out just what the expan-
8 sion and contraction is of a pipe that size, or any
9 size, with changes in temperature. If the gas is going
10 through, at a certain temperature range, perhaps or
11 within a very certain minimum temperature range, suppose
12 something happens to the units that are keeping it down,
13 keeping the temperature down, suppose it doesn't --
14 they are no longer down. What happens? I know that
15 the pipe, if it gets hotter, the gas gets hotter, it's
16 going -- the pipe is going to expand, and this is
17 evidently what happened here. And of course, as it
18 rose, these saddles, saddleweights which were put on,
19 and as far as I can find out, now I wasn't there at the
20 time, I didn't see them, but I talked to the chap who
21 supervised the putting in of these weights.

22 He said that when the weights
23 were put on that pipe, he couldn't see the pipe, and I
24 asked him how he knew they were centred and he said
25 "I don't, I don't know whether they are centred on that
26 or not", so anyhow there is only one weight left, and
27 the pipe was exposed. Okay, let's go on to the next
28 one.

29 Here's what Westcoast has
30 done. They have built a berm over that exposed pipe,

1 and it's completely covered now, it's weighed down. I
2 don't know whether they put any weights on it, I doubt
3 very much if they put any more weights on it. That
4 berm was effective as a temporary measure, but look here.
5 The berm has caused surface water to dam up here, and
6 it is commencing to break through into here. I'll bet
7 if I went back now, that would be just a creek flowing
8 across there and the pipe would start working up again.
9 That's my guess, now I haven't done that. Okay?

10 Now, we're in the permafrost.
11 This is -- remember that picture I showed you of the
12 big chunk of ice, that big ice lens, big mass of ice,
13 this is it, right there, same spot, so that ice evi-
14 dently has melted and we have got some collapse right
15 in that particular spot. Evidently there was more ice
16 in here, I didn't see any, but there's been other
17 collapse along here. This was all a permafrost area in
18 the till, and this right here is where that piece of
19 ice, that mass of ice about two by four feet. That's
20 where it existed. Okay.

21 More thermokarst and till,
22 this is another permafrost area and you can see that
23 there is a little bit of a creek flowing along here,
24 and certainly we found, and I'll show it to you, some
25 of the ice segregations, the small ice lenses in the
26 till, and this is the sort of stuff that happens after
27 the ice starts to melt. Okay.

28 This is another spot where we
29 have some thermokarst, just minor thermokarst here,
30 but this was another permafrost in till area, two years

1 after the pipe was laid.

2 Another spot, I don't know
3 exactly what happened here, but we are now in the same
4 situation. We have got thermokarst of some sort occur-
5 ring in the permafrost and till.

6 Now, at the edges of each one
7 of the permafrost areas, there was a sign. This sign
8 says "Permafrost", this is one end; at the other end
9 there's another. I don't know who put the signs up but
10 they are extremely handy, and they are right on, they
11 are right on what I have in my notebook as the edges
12 of these various permafrost areas.

13 Over here 200 feet. A recent
14 seismic line came right out to the permafrost. There's
15 no reason, I don't see why, with that sign there identi-
16 fying where the permafrost area is, why that seismic
17 couldn't have come over here and kept out of it, because
18 by coming through the permafrost, you could see the
19 degradation starting on the seismic line. Okay.

1 This is a cut in lacustrine
2 and silty sand, roughly one mile back from the Kotaneelee,
3 the famous Kotaneelee bluff, and we walked this line,
4 we spent three days and walked it because I thought the
5 only way to get a good feel of it would be to walk it
6 and examine every little detail.

7 Looking at it from here, looking
8 at this thing we were coming from right to left, I thought
9 well it looks like Westcoast or somebody has been through
10 here, trying to do a little maintenance job and there's
11 been some sliding here and they sort of pushed that
12 toe off. Well that's fine except as soon as they put it
13 off, then of course more will slide down. It would be
14 better if they left it, because the pipe is away over
15 here and the integrity of the pipe is okay.

16 However, let's have the next
17 one. I go down to the bottom and looked up, this is the
18 same shot from the other end. My humble opinion, that
19 wasn't caused by the company. There's just no way.
20 I mean, that to my mind and I'll argue, that that is
21 seismic. That's the cat train that's come down here
22 with a cat and his sleighs and he's come across here.
23 But you notice how, whatever it is, whether it's West-
24 coast or the seismic, it's not a very good spot to be.

25 Do you notice the breakers?
26 This was cut here and pushed over here with a cat, this
27 is all fill in here. This is all fill right in here.
28 Now the breakers have carried over and dropped it over
29 the side of the fill, look at the erosion along the side
30 of the fill, so those breakers are effective, they are

E.B. Owen
In Chief

1 really working. They are working too well, because
2 they are starting to take out this, and of course there's
3 a little creek along the bottom here and there is some
4 sliding in there too.

5 This is ^a /cut in the bedrock,
6 taken and excavated by bulldozer, and certainly it's a
7 good stable cut, there would be no trouble. I apologize
8 for the picture, but I think it was the last one on that
9 roll and it didn't turn out too well, but it's just
10 straight, crustaceous sandstone and silt stone, shale and
11 it came out very well. Okay.

12 Here is the Kotaneelee bluff,
13 the famous Kotaneelee bluff, from the air as we approached
14 it from the chopper. This is the pipeline here, we are
15 looking south, we are just about over the Kotaneelee
16 River with the chopper. There's the pipeline here, you
17 can see faint lines of the breakers This is a very
18 deep ditch along the edge of this cut slope on the east
19 side of the bluff. Okay.

20 Wait a minute, go back, will
21 you Al for just a minute please? No, keep going back.
22 Yes.

23 You will notice this -- one
24 thing I can't understand, and why they didn't -- why
25 Westcoast Oil Company didn't trim that down there
26 because actually you come up here, you come up and then
27 come down, and to me, I can't really see. There is
28 almost a knob there, and when they came down over the
29 top, they had about six feet of silty sand and then they
30

1 ran into about four feet of a fine gravel, which made a
2 lot of water, and as the ditching machine came down this
3 slope, it was very steep and so they had a deadman, they
4 had a cat up here and he came down on the cat, I mean
5 he was winching his way down to dig, and as the ditcher
6 machine passed over that gravel, the water started to
7 follow it down. I remember looking at it and thinking,
8 my goodness, what's going to happen here, but actually
9 I went back on the other side and that was just a knob,
10 and there was no spot that that water could come from,
11 and it drained out in two or three hours. That little
12 gravel was drained dry, but I just can't
13 figure out why they didn't -- if they had come down
14 there a little deeper, that would have cut that grade
15 down.

16 Now a little bit closer. You
17 can see the breakers taking the water away from the
18 pipeline which is buried here. Breakers coming over
19 here, carrying water which creates quite a big trench
20 right in there.

21 We are looking down now.
22 Pipeline over here, breakers carrying water from the
23 pipeline. The sand bag breakers in this case, over
24 to this gulley, which is eroded along the edge of that
25 cut slope on the east side.

26 Here's a shot of the cut slope
27 I'm looking at, it's about -- that's that ditch which
28 has been eroded by surface water, and it's about five
29 feet deep in here. You can see the breaker carrying the
30 water in, and I don't know, I think I explained that.

E. B. Owen
In Chief

1 I think Westcoast plan on doing that. I understand
2 that actually the company has been doing some rehabilit-
3 ation work in there this summer. I'm not sure just what
4 they have done, but I understand they are working on it.

5 This is quite a serious thing,
6 because as that ditch keeps eroding, the slope comes in.
7 More material falls down, and it's eroded out, more
8 material erodes out, and naturally there's no stop to it,
9 until they can somehow control that surface water eros-
10 ion.

11 Okay, now we're at the Kot-
12 aneelee channel switch from the main channel over here,
13 where the pipe was really buried beneath the water.
14 It's switched over to here, exposed the pipe, so West-
15 coast went in and they bulldozed gravel off the stream
16 bed, put a big berm over the exposed pipe. The pipe is
17 buried beneath there now.

18 A shot upstream showing the
19 same thing. Their dozers actually went in, pushed off
20 through that bar/^{under} the water, up onto the berm. Now,
21 in my report I questioned how the heck the Department
22 of Environment or Fisheries people could permit a thing
23 like that, because I spent almost two years on these
24 gravel contracts. We were looking for gravel from Simp-
25 son to Inuvik and Tuk, and there were numerous contracts
26 out, and one stipulation we had in our consultants who
27 were looking for the granular material, "Don't go near
28 the river. We won't accept any material that you are
29 going to take out of a gravel bar on the river". This
30 was the background of our whole end of things

1 and here I come on this job and what do I find. I find
2 that actually not only have they taken stuff from the
3 river, but they haven't even loaded it, they have just
4 pushed it through. Just think of the silt that has gone
5 downstream, but this -- and I don't know how they got
6 around it. I really don't know, actually I just reported
7 to Indian Affairs what I saw, and I don't know what's
8 going to happen, if anything.

9 Okay, now we're looking south
10 from the south, and that's the LaBiche River here. This
11 is the south channel of the LaBiche, it actually curves
12 around like this. The river is flowing from right to
13 left, and the pipeline is actually coming right through
14 here.

15 Now, when they dug the trench
16 across here, the spoil bank was on this side. It
17 acted as a dam, and the water started to back up and
18 come through here. I know one night I got stuck in
19 there, I had to get pulled out by a bulldozer, but they
20 had quite a deep -- the bulldozer actually opened up
21 that channel, which was wise, in order to release the
22 pressure on here.

23 Now, the Fisheries people were
24 in there, and I got this through one of the chaps work-
25 ing with Dr. Fyles' and they took some samples of the
26 water for silt content. This was while the job was on.
27 They took samples of the water right close to the ditch,
28 and they took samples all the way down roughly a mile
29 or so downstream, and they found that there was actually
30 no silt in the water directly here, but once they got

1 down below where that channel come back in, they had
2 extremely high silt content. I wasn't personally in-
3 volved in that, but a chap phoned me up and asked me
4 how that could happen, that they got a mile or half
5 a mile downstream, they could get very high silt contents
6 where here, right up against the dyke or the ditch,
7 they got none.

8 Well this water was stagnant,
9 it wasn't flowing. Over here they had a cat open that
10 up, there's no doubt that that's why their high silt
11 contents were further downstream.

12 Well could I have just that
13 last one back please? The south side of the La Biche
14 River Valley is not really a wall, it just sort of
15 turns up. The LaBiche itself was a glacial fluvial
16 channel, and the alluvium goes back to about here, the
17 alluvium from the river, but from then on, we have got
18 sand and gravel for about a mile.

19 There are two terraces in here,
20 on the -- between the upper and the middle terrace,
21 between the two terraces actually, there's an air strip
22 right in here. That air strip was abandoned, it wasn't
23 used while I was there, but there's one thing I wondered
24 about is why, when Westcoast was building their pipeline
25 through here, why they put a chopper pad in the bush
26 over on this side and when they had that entire air
27 strip over here.

28 They came up -- it was a long
29 one, about 2,000 feet, and yet they went in this bush
30 and over here and built a chopper pad. I couldn't figure

E. B. Owen
In Chief

1 that out because actually it wasn't in the permit. I
2 mean, theoretically they shouldn't ever do a thing
3 like that.
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1 This is at the south
2 channel of the LaBische where the dozer pushed it
3 out. There's not much left there now. It's just a
4 pretty little spot to go fishing.

5 Now this is the north wall
6 of the LaBiche Valley.

7 THE COMMISSIONER: This is
8 what?

9 A The north wall of the
10 LaBiche Valley.

11 Q Oh yes.

12 A Westcoast have constructed
13 a dike across here, in order to stop surface water
14 erosion coming down along in here. We've got bedrock
15 along in here, a little bit of gravel and the rest is
16 till.

17 Looking down the other way,
18 this is the dike, they opened up a small borrow pit
19 over to our left, pushed the material over and stopped
20 erosion on this terrain over here, which was -- and
21 you can also see some sloughing along the slope as you
22 look down. There's the pipeline going off to the river.

23 There's the borrow pit that
24 Westcoast opened up to make the material over the top
25 of the bluff. The shoo fly, that is the detour, that's
26 the detour coming out here, came across, up around and
27 onto the right-of-way.

28 This is a section and a half of
29 pipe. I think it's probably 20 inch, I didn't measure
30 it, but this is the pipe that Westcoast planned on

1 using in their rehabilitation efforts. I don't know
2 exactly what they planned on doing with it. I never
3 saw it installed but all along the job, there were
4 two or three sections of this stuff. Evidently they
5 were going to backfill some of these water eroded gulleys
6 and then after they had got them filled they were going
7 to put the pipe on top of the fill. This, I assume
8 it's going to do, but really I don't know.

9 Now into some of our
10 seismic friends. This is a cross-over. The seismic
11 built that to go from one side of the right of way to
12 the other. We counted nine of these things, checking
13 with the Fort Liard people, the RMO at Fort Liard, he
14 only knew of three. It's made of material which they
15 excavated off from the side of the right of way, they
16 cut some logs. made a corduroy, put more material on
17 it, and moved across, the pipe itself would be quite
18 protected but as far as I could find out, after writing
19 my report, there was no permission given for any of these
20 by the -- by Indian Affairs and also talking to
21 Westcoast people, they didn't seem to know just who
22 was responsible for the integrity of the pipe, when
23 people like this were allowed to work on it. The
24 seismic people went along the right of way, they went
25 across the right of way and let's have the next one.

26 And they dug borrow pits
27 along the edge of the right of way, this was one they
28 used to get material to build a cross over.

29 Here's another one. They
30 actually came out of the bush, the dozers pushed the

1 material up over the pipe and they just moved right
2 across. They didn't even corduroy this one. Well they
3 flew in a few logs but it didn't look like much of a
4 job.

5 Here's a stream right on the
6 right-of-way which somebody blocked and never bothered
7 to open up. Certainly it wasn't the company, that was
8 seismic for sure.

9 Here's the prize one here.
10 In this particular instance, somebody and this is the
11 pipeline is about here, we're looking south so the
12 haul road would be along here, someone and it happened
13 after the frost had gone out of the ground, or previous
14 to freeze up, had come down along here, got over, there
15 was a creek in here, they corduroyed that wet spot,
16 dammed up the creek and then they came back down the
17 right of way. The creek was never opened up. Certainly
18 that wasn't done by the company because we were never
19 in there at the time of the -- where there was no
20 frost, when it was open like that, but you can see
21 what happened. That creek is flowing that way. This is
22 all the result of --the pipe lays underneath that.

23 Another example, this is
24 more of our seismic friends. This is along one side
25 of the right-of-way, and somehow they've rooted that
26 stuff out and pulled it up along the side,

27 This is what it looks like
28 where they haven't been. This is what happened after
29 the fire sled had been through.
30 Some of these trees have fallen in and they certainly

1 should be removed, but this is the sort of stuff that
2 -- the sort of way it should be all the time.

3 Okay, now we're up in the
4 gathering system. This is in the permafrost area. The
5 pipe has been sitting on these posts, it goes right
6 through here and on up, this is for expansion and
7 contraction. There has been no effort to control that
8 particular stream, actually it seems to be in pretty
9 good shape because the pipe is in the air, so there's
10 no chance of it being eroded. Well we had some trouble
11 with that post. This is the sort of thing in the
12 gathering system where you would have permafrost, a
13 discontinuous permafrost, and certainly -- you notice
14 how the sides, that was all hand cleared. No machinery
15 at all except for the air installing the pipe.

16 We're in the gathering
17 system again which started out towards Pointed Mountain,
18 this is mostly gravel, grainy materials, glacial
19 fluvial granular material, you've got a breaker here,
20 the pipe is up here, you can't even see the pipe in
21 this particular case.

22 Let's go a little bit higher.
23 Okay, we're up in the Pointed Mountain, we're getting
24 near the top, the mountain's up over here. there's a
25 well up here, and now we're into mostly talus
26 and well drained gravels, chopped up rock, there's a
27 little bit of a ditch forming over the pipe, very
28 little. Once again we've got the breakers, leading off
29 and that is the end.

30 THE COMMISSIONER: Well thank

1 very much Mr. Owen.

2 MR. GOUDGE: To complete Mr.
3 Owen's evidence, Mr. Commissioner, we could perhaps
4 file his two reports.

5 THE COMMISSIONER: Yes, and
6 I wonder if it could be possible to obtain copies of
7 the slides to be marked as exhibits.

8 MR. GOUDGE: Yes sir.
9 That can be done.

10 THE COMMISSIONER: To con-
11 stitute a part of the permanent record of the Inquiry.

12 Well do you want to come
13 back at 8:00 for cross-examination.

14 MR. GOUDGE: Yes, sir, if
15 that's convenient.

16 THE COMMISSIONER: All right,
17 we'll adjourn until 8:00 this evening.

18
19 (REPORT: OBSERVATIONS OF THE POINTED MOUNTAIN
20 GAS PIPELINE, FEBRUARY, 1975 MARKED AS EXHIBIT
21 269)

22 (REPORT: ENGINEERING GEOLOGY OF THE BURIED
23 HOT GAS PIPELINE BETWEEN POINTED MOUNTAIN AND
24 BEAVER RIVER, E.B. OWEN, JUNE, 1975 MARKED AS
25 EXHIBIT 270)

26 (SLIDES USED BY E.B. OWEN IN PRESENTATION
27 MARKED AS EXHIBIT 271)

28
29 PROCEEDINGS ADJOURNED UNTIL 8:00P.M.
30

1 (PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

2 MR. GOUDGE: Mr.

3 Commissioner, before the cross-examination of Mr.
4 Owen, I've been advised indirectly from Mr Anthony
5 that CARC have taken the decision not to call any
6 evidence in Phase I, that the witness and the evidence
7 that they would have led in Phase I they now feel is
8 more appropriately led at the end of Phase II, III and
9 so we will be hearing from them then with what we
10 might have heard right after Thanksgiving and Mr.
11 Anthony wanted that put on the record, so all counsel
12 are now advised of that.

13 CROSSEXAMINATION BY MR. BELL:

14 Q I see sir that from
15 your ciriculum vitae that one of the projects which
16 you participated in when you were assigned to the
17 Water, Lands, Forest and Environment Division of
18 Northern Affairs, was the Land Use Regulations for the
19 Northwest Territories and the Yukon Territory. I was
20 wondering sir if you could tell us just what exactly
21 your role was in that project?

22 A Indian Affairs did not
23 have a geologist on their staff and they requested the
24 Geological Survey of Canada give them someone and I was
25 the joe boy once again, and Mr. John Naismith was the
26 director at that time, and the first thing he did
27 was to send me north into the Arctic Islands, for
28 about two months, quite a change from the Niagara Falls
29 I'll tell you. I was working down in the Niagara
30 Penninsula for four years and then to be suddenly sent

1 up to the Arctic Islands is quite a change. They were
2 then in the process of drawing up the Land Use
3 Regulations, but they were still just mostly verbal,
4 there was very little on paper. I visited just about
5 every oil exploration set up that was up in the islands,
6 this would be in '71, most of the seismic crews, some
7 of the rigs that were drilling, and then following that
8 I went over to the Yukon and repeated the process, at
9 that time with the R.M.O., their Resource Management
10 Officer from Dawson. We were up in the Eagle Plain
11 and all in through there. I came back and wrote
12 a report, much of that report was incorporated in the
13 Land Use Regulations.

14 Q Did your report deal
15 with activities of seismic crews and Gulf Oil and --

16 A Definitely. I discussed
17 with various bulldozer operators, mostly because I'm
18 very partial to bulldozer operators the various types
19 of mushroom shoes and snow shoes and everything else
20 that they could put on their cats to keep their blades
21 in the air.

22 Now you must remember I came
23 from a construction job where we were very busy utilizing
24 every bit of equipment we could to the best of its
25 ability and suddenly to be sent up where I had to turn
26 my whole picture around and start lifting a blade off
27 the ground, was somewhat foreign to me, but we had a
28 number of discussions and some of the operators, I talked
29 to and their supervisors had some excellent ideas and
30 these were all incorporated into the report.

1 Q I see, we can say then
2 that you're reasonably familiar with the specific terms
3 of the Land Use Regulations?

4 A Well I understand they
5 have been changed in the last while. I'm not sure of the
6 exact -- all the details as of right now. I was
7 quite knowledgeable about the original Land Use Regulations
8 that came out, what was it, back in '71, something of
9 that order.

10 Q Well you say on the first
11 page of your evidence that the Pointed Mountain Gas
12 Pipeline is the first pipeline for which specific
13 provisions to rehabilitate the right-of-way were required
14 under the authority of the Territorial Land Use
15 Regulations and we can assume that you were familiar
16 with the regulations as of this time of the
17 construction of Pointed Mounted Pipeline. .

18 A Yes.

19 Q Tell me sir, did you in
20 any of your visits to the site of the Pointed Mountain
21 Pipeline observe anything which would give you grounds to
22 believe that there had been a failure to comply with any
23 of the regulations.

24 A Well, the company got
25 a permit and in that permit was laid down what they had
26 to do and what they couldn't do, but mostly what they
27 could not do more than what they could do, because the
28 Land Use Regulations are actually a negative quality.
29 Like an environmentalist, they never say yes, they
30 always say no . So the result is that -- no, I never saw

1 anything that I could actually say. In my report to
2 Indian Affairs on that detail, I just described what
3 I saw and it was up to the people at Indian Affairs to
4 interpret my report. That's the way I worked for many,
5 many years and when I turned in this terrain damage
6 report, it was up to them to interpret it. I said that
7 this had taken place and that had taken place, but I
8 had no idea whether or not Westcoast as a company
9 had applied for a permit to open up a quarry here or
10 a pit there. It wasn't my job.

1 Q I see, so it would have
2 depended on the exact terms of the permit?

3 A Exactly.

4 Q You showed us some slides
5 or damage which you thought had been done by seismic
6 crews, and I was wondering if you could tell us if any
7 of that damage would give you grounds to believe that
8 there had been a failure to comply with Territorial
9 Land Use Regulations?

10 A Yes. In my own opinion,
11 now, they may have got permission to open up borrow pits
12 off the right-of-way to build cross-overs, but after I
13 had observed these things, I went down and asked the
14 R.M.O. at Fort Liard, and he had no knowledge of it.

15 Now, if the representative in
16 the --

17 THE COMMISSIONER: What is the
18 R.M.O.?

19 A The Resource Management
20 Officer. In the old days they were called fire rangers,
21 I believe. In Ontario they are called fire rangers, but
22 they are Resource Management Officers. He had no
23 idea --

24 THE COMMISSIONER: What were
25 they called in the old days?

26 A I always called them fire
27 rangers, sir, I'm not sure what they are --

28 THE COMMISSIONER: Fire
29 engines?

30 A Fire rangers.

1 THE COMMISSIONER: Oh, fire
2 rangers. Forest rangers.

3 A Forest rangers, I guess
4 it would be a proper term, and they had no idea down
5 there. For example, I think in my report I said that
6 we had counted nine cross-overs that the seismic people
7 had constructed. They had knowledge of three. They
8 had no idea in Fort Liard that borrow pits had been
9 opened up to construct these cross-overs, and to my own
10 mind, I was sort of disgusted, the fact that in one
11 instance they had actually gone out into a well marked
12 permafrost area.

13 MR. BELL:

14 Q Is that the one we saw in
15 the slide?

16 A Yes.

17 Q And the cross-over was
18 also the one we saw in the slide, the one you just
19 referred to?

20 A I beg your pardon?

21 Q The cross-over of the pipe-
22 line right-of-way?

23 A Yes.

24 Q That was the one that you
25 showed us earlier?

26 A Yes, I showed you two
27 actually. I showed you one cross-over, then I stood
28 with my camera and I shot down off another one into a
29 borrow pit, which they had opened up.

30 Q Do you know if it is, or

1 if it was at the time, at any rate, the practice of
2 the Northwest Lands and Forest Service to inform the
3 local R.O.M. of any permits that would be issued in its
4 area?

5 A Oh definitely, they
6 should be completely in the know, they should know
7 everything what's going on. In this particular instance,
8 they didn't.

9 THE COMMISSIONER: Well the
10 R.M.O. works for who, the Territorial Government or the
11 --

12 A Indian Affairs, sir.

13 MR. BELL:

14 Q Are you aware if any
15 remedial action or any attempt to contact or find out
16 how this could have happened, do you know if anything
17 like that occurred after the information was brought to
18 the attention of the local R.M.O.?

19 A Well certainly there had
20 been very little remedial action when I went there in
21 June of '74. There had been some attempt at rehabilita-
22 tion, but it was of a stop-gap nature.

23 MR. BELL: Excuse me just a
24 second.

25 Q Do you know if there were
26 any -- when I asked you about if there were any remedial
27 measures taken to repair the damage, you said that some
28 attempts had been made in one or two cases. Do you know
29 if there were any administrative actions taken to try
30 and make the enforcement authorities aware of these

1 problems, of these failures to comply with the regulat-
2 ions --

3 A No sir, I do not. I don't
4 know what happened.

5 THE COMMISSIONER: Mr. Owen,
6 yesterday Mr. Templeton was discussing the problems of
7 ensuring that any rules and regulations you lay down in
8 relation to pipeline construction are in fact obeyed.

9 In this Pointed Mountain thing,
10 you said that their seismic cuts traversed the line,
11 the right-of-way at nine places, and the R.M.O. at Fort
12 Liard could only account for three permits having been
13 issued?

14 A No, not three permits,
15 sir, only three cross-overs. I don't know whether they
16 would all be one permit, one seismic outfit or not.
17 This I don't know, but there are only three cross-overs
18 on his map.

19 THE COMMISSIONER: I see,
20 well three of the nine?

21 A Yes, sir.

22 THE COMMISSIONER: Well now,
23 you also mentioned that gravel had been taken from a
24 gravel bar in a river, and you showed us a photograph
25 of it. I've forgotten, was that Westcoast or was it
26 somebody else?

27 A This would be the company,
28 this would be Westcoast, sir, in order to cover the
29 exposed pipe on the south side of the Kotaneelee River.

30 THE COMMISSIONER: Yes.

1 And what was the permit situat-
2 ion there?

3 A I have no idea, sir.

4 When I put in my report I questioned that, because I had
5 no idea, and all I was doing in my report was drawing
6 the attention of Indian Affairs to the fact that this
7 particular situation existed.

8 THE COMMISSIONER: Yes.

9 MR. BELL:

10 Q Just one question which I
11 should have asked earlier. In your reports to Indian
12 Affairs about your observations on the Pointed Mountain
13 gas line, can you tell us to whom you reported?

14 A To the director of the
15 Water, Forests, Lands and Environment Division.

16 Q Is that the predecessor
17 of the Northwest Lands and Forest Service?

18 A I really don't know.
19 Before it was called the Water, Forests and Lands
20 Division, and then they worked the word "environment"
21 in, and it became Water, Forests, Lands and Environment,
22 but it's the same group of people.

23 I don't know about the North-
24 west -- I'm sorry, what was the rest of it?

25 Q The Northwest Lands and
26 Forest Service?

27 A I'm sorry, I don't know
28 where that fits in the hierarchy.

1 MR. BELL: Thank you very
2 much. Those are all the questions I have.

3 MR. BAYLY: Mr. Commissioner
4 I will be in my cross-examination, referring to a report
5 which on checking with Mr. Bell and others, I find has
6 not yet been listed as a document within our possession.

7 I think I should give the title of that for the
8 record. It's called a Case History of the Pointed
9 Mounted Gas Pipeline prepared by the Northern Assessment
10 Group and I will send a letter listing that to the
11 other participants.

12 CROSS-EXAMINATION BY MR. BAYLY:

13 Q Mr. Owen, in your
14 cross-examination by Mr. Bell you referred to a permit
15 received by the Westcoast Transmission Company, and
16 I gather they also entered into a form of indenture
17 agreement with the Federal Government when they con-
18 structed this pipeline, is that correct?

19 A Yes, this is correct.

20 Q And that was generally,
21 I understand, to cover the whole of the project.

22 A As far as I know, yes
23 but I'm not sure.

24 Q Are you aware of whether,
25 for any of the ancillary activities to the pipeline
26 construction Land Use Permits were issued, apart from
27 the indenture?

28 A What ancillary --

29 Q I'm thinking of some
30 of the operations we saw in your slides such as borrow,

1 facilities, such as timbering and I gather burning
2 of timber from the right-of-way, I'm just wondering if
3 to your knowledge these were all included in the inden-
4 ture agreement.

5 A Are you referring to
6 the maintenance part of Westcoast or to the seismic
7 operations which are a separate identify completely.

8 Q All right, I'm going to
9 deal with the seismic later, but I want to get
10 straight in my mind how Westcoast came to get per-
11 mission to build this pipeline. I gather they entered
12 into an agreement with the Federal Government which you
13 have referred to as a permit and I have referred to as
14 an indenture agreement, I'm wondering if you know
15 whether there were other permits issues to them to do
16 the things necessary to construct a pipeline say off the
17 right of way.

18 A Not to my knowledge sir.
19 I have a copy of the original permit here, but I don't
20 know of any other permit that was issued.

21 Q Yes and under the terms
22 of the permit as we'll call it, I gather that Westcoast
23 Transmission undertook to do a number of things, and
24 among those were erosion and drainage control and
25 slope stability?

26 A Yes sir.

27 Q And if I interpret your
28 comments and your slides correctly, at least as far as
29 the summer of 1974 was concerned, these did not appear
30 to have been done entirely satisfactorily?

1 people invaded the Kotaneelee area and I don't know
2 exactly what the result is. I understand though that
3 Indian Affairs are still busy writing the report.

4 MR. BAYLY: Sounds like they're
5 making their best efforts to spend that \$500,000.

6 Q Now, getting back to
7 this, Mr. Owen, did it strike you as a strange thing
8 that going back, what you have said was three break
9 ups after the project had been completed, as far as
10 the construction was concerned, to find that the damage
11 that you saw had either gone unrepaired or that the
12 repairs were in the shape that they were in?

13 A Yes, it did surprise me.
14 Indian Affairs wanted me to go up right after the
15 first breakup, there was some talk that I should go in,
16 but I suggested at least two breakups, two runoffs
17 should take place before I went in to give them a chance
18 to assess what the damage was, so they could go ahead
19 with their rehabilitation efforts. I couldn't see any
20 point in wading -- going in right after the job had
21 been completed because the water -- surface water
22 erosion which is the chief culprit along that line,
23 wouldn't really would show up and the result was that
24 when I did go in, it was three spring breakups after.

1 A That is correct.

2 Q And I gather one of the
3 things that Westcoast did as well was to put up a bond,
4 or put up a cash amount, to ensure the performance
5 of the things they had agreed to do, is that correct?

6 A That is correct, I've been
7 so advised, that is the case, I have no idea. When I
8 went up to do the terrain damage -- check the terrain
9 damage, I was told this was the case, and that Westcoast
10 wanted their money back and it would depend on my report.
11 That's just verbatim what I was told.

12 Q My information is that
13 that was \$500,000, is that your information?

14 A Yes, of that order.
15 I'm not sure of the exact figure.

16 Q All right. Have you any
17 idea of whether they have received their money back as
18 a result of your report or in spite of it?

19 A I would venture to say,
20 in my own opinion that they haven't got it back.

21 THE COMMISSIONER: Well is it
22 your opinion that they shouldn't get it back?

23 A Yes sir, until I have
24 seen the results of their rehabilitation efforts. I
25 understand that Indian Affairs -- Department of Indian
26 and Northern Affairs sent a delegation of some five
27 individuals up about six weeks ago with, all together
28 three helicopter loads --

29 Q What --

30 A Three helicopter loads of

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1 Q We have had reference in
2 your evidence to the fact that you have a copy of the
3 permit there, and 'I'm just wondering, Mr. Commissioner,
4 whether Mr. Goudge intends to make this available to the
5 Inquiry. I'm assuming it's a public document, but it
6 might well be made an exhibit, if that seems to make
7 sense to you, sir.

8 MR. GOUDGE: My information
9 at the moment, Mr. Commissioner, is that it is a public
10 document. I would like to check that, and assuming
11 there's no difficulty about that, we would be glad to
12 tender it as an exhibit.

13 MR. BAYLY:

14 Q Now from your evidence,
15 Mr. Owen, it appears that other people, other companies
16 or whatever, had begun to use the pipeline right-of-way
17 for activities not directly related to the maintenance
18 of the facility. Would that be correct?

19 A Yes, this is correct.

20 Q And you had said that
21 these appeared to be seismic operations, and perhaps
22 you could give us your reasons for believing that that's
23 what they were?

24 A Well the one photograph
25 showing the seismic line coming out and going right over
26 a cross-over, to me is the crux of the whole thing.
27 Walking along the line before we came to these cross-
28 overs.

29 Now, I had been on the job from
30 the start, I knew just what Westcoast had done. I had

1 talked and worked with their inspectors and their
2 engineers. I found powder boxes which I knew Westcoast
3 didn't blast. I found blasting cable, which I knew
4 shouldn't be, and there was all sorts of things which
5 obviously were not left behind, debris left behind by
6 the company.

7 Even before I came upon these
8 cross-overs, it was obvious to me that somebody else
9 had been along there.

10 Q And it was after that
11 that you went to the officer in charge, and he told you
12 he was aware of three such operations, and you informed
13 him that there were six that he wasn't aware of?

14 A He was surprised.

15 Q Now, -- I should think.
16 Did you see a great deal of seismic activity branching
17 off the main transmission line?

18 A Yes, there was quite a
19 lot. Some of them came up -- I think -- well any smart
20 seismic operator would use that right-of-way if he
21 could get on it for his camp. He could move his
22 trailers along it, it's easy going, and then he would
23 work off into the boondock, into the bush with his cats
24 and his seismic equipment, but he would keep coming back
25 to that line because there's no way that he would want
26 to drag his trailers through the bush when he had the
27 nice, clean line to work on.

28 Q Yes. And if I were to
29 suggest to you that this is a common practice on a
30 transmission right-of-way, that if anybody gets a chance

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1 to use it, as a road or winter road, generally speaking
2 people do that?

3 A They would be if they could
4 get away with it.

5 Q And in your report, have
6 you made any recommendations about the limited use of
7 this transmission right-of-way?

8 A No sir, I have not, because
9 I think that's up to Indian Affairs. I pointed out to
10 them what had taken place. It's in their ball park now.

11 Q I see. If you were
12 making recommendations to this Commission, would you
13 recommend that their major transmission lines be some
14 sort of regulation on the use of those after the facility
15 is installed?

16 A Yes, I would. I under-
17 stand that in other parts of the country, the pipeline
18 people have difficulty with this very thing. In most
19 cases, it's a matter of skidoos or of smaller equipment,
20 but up here where there is still seismic operations,
21 and what-not, heavy equipment, big stuff, there should
22 be some sort of legislation to prevent these.

23 Actually at the moment, there
24 is no reason why seismic people can't go down right
25 down that line and blast. As far as I can think of,
26 they can go down there and shoot just as if they were
27 off ten miles from the pipeline. There's nothing to
28 stop them, as far as I know.

29 Q They would have to, I
30 gather, get a land use permit in order to do that --

1 A Yes, and when they get
2 the land use permit, they draw lines on a map saying,
3 this is our seismic line, but it's pretty hard to prove
4 that they are exactly where the line is on the map .

5 Q Yes.

6 A You realize a pencil line
7 on a four mile map is 200 feet, just a 1H pencil, so
8 it's rather difficult to show exactly where they are.

9 Q Yes, and we shouldn't be
10 surprised to find that seismic activity increases after
11 a major transmission facility has been installed, would
12 that be fair to say?

13 A This is true. While West-
14 coast was building their line, there were I think two
15 seismic companies working in there, right -- well in
16 one instance, one seismic drill upset on the Shoo-fly
17 in the LaBiche River. I was stuck behind it for two
18 hours while they uprighted it, and this is while the job
19 was on.

20 Q So the two operations
21 were going along at the same time and using the same
22 roads and --

23 A Well the seismic people
24 would come out to the right-of-way and then move back
25 into the bush again.

26 Q Yes. Now, my understand-
27 ing, Mr. Owen, of this project from some evidence that
28 we had from, I believe it was Dr. Hardy and the panel
29 that he was on from Arctic Gas, was there were a number
30 of government inspectors on the job during its

1 construction. Are you aware of how many inspectors
2 there were and what their roles were?

3 A I read that too. I read
4 that also. I can only recall there was Dale Kepke,
5 who was the R.M.O. from Fort Liard. He came around
6 approximately once a week, at least I saw him about once
7 a week. The only other two that I know were two
8 Fisheries people. They were the chaps that took the
9 silt samples on the LaBiche River, and they were inter-
10 ested in the gravel bar that we were taking the concrete
11 aggregate from, and except for that, I never saw anyone
12 else.

13 Now, there may have been other
14 chaps come in, because I was out on the job from perhaps
15 eight in the morning until six or seven at night. They
16 may have someone come in and visit the office and per-
17 haps go out on the job and go back and I never saw
18 them, and then there was the National Energy Board man
19 who came in one day, with whom I drove around, the one
20 day he was there.

21 Q And over what distance
22 would this project be being constructed at any one
23 period of time with the inspectors?

24 A You're thinking of the
25 pipeline itself?

26 Q Yes.

27 A Well it went full blast,
28 she was end to the other, 34.1 miles. They were --
29 sorry.

30 Q Go ahead.

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1 A They were excavating, or
2 they were grading at the upstream end, at the Pointed
3 Mountain end, and the ditchers were moving in at the
4 other end. Once they got going, it was just one big
5 flow sheet.

6 Q And in your estimation,
7 were those sufficient inspectors for a project of this
8 magnitude, or would you recommend that there be more
9 and they have more diversified roles?

1 A I think the inspectors
2 that Westcoast had were very good. They were all
3 experienced, I think three of them were ex welders,
4 they knew pipelining backwards, there was no doubt about
5 that. They were not proficient in determining perma-
6 frost, none of them knew permafrost. I recall when we
7 first found, we ran into the first permafrost, in the
8 till, I was following directly behind the three ditching
9 machines and when the backhoes weren't busy digging out
10 little sloughs here and there, they were up on the line
11 too. It's pretty difficult to go back and forth and
12 at one time, I asked the ditching machine operator,
13 the one who hit the first permafrost. when he hit it
14 again take a good look and remember where it was. And
15 he said to me, he says. is that permafrost and I said
16 yes. He said we got lots of that on the line between
17 Beaver River and Fort Nelson. So -- but the inspectors
18 themselves until I -- well let's face it, there was
19 one inspector who looked after the clearing, the
20 grading, the clearing at the front end and then there
21 was the trenching inspector, all knowledgeable chaps.
22 And they had no idea what permafrost looked like.
23 The inspector who was -- there was one who was sort of
24 a floating man and they put him in charge of the drill,
25 looking to extend the limit of the permafrost beyond
26 the trench, and he had no idea. I was with him on the
27 drill several days until he realized what permafrost
28 was.

29 Q Now when you say inspectors,
30 and you've referred to the welding and the clearing

1 inspectors, et cetera are these company officials, these
2 inspectors or are these inspectors from the National
3 Energy Board or the --

4 A They worked for the
5 company, they had been with the company some time, most
6 of them and it was through them that I got to know
7 all the -- what had gone on on other jobs which the
8 company had been in on. Relations were extremely good.
9 In fact relations were extremely good with the company and
10 myself as well as the inspectors. But most of the
11 information I got was from the inspectors.

12 Q Now did you feel that there
13 was enough government inspection on this project?
14 I don't mean to have you comment at all about the
15 competency of the people who were doing the inspection,
16 but did you feel that they were there frequently enough.
17 You've spoken of one man coming once a week and two
18 fisheries people taking siltation samples at the river
19 crossing. Is this ample for a project of this kind
20 in your opinion?

21 A Well it can reach a
22 point where there are too many inspectors. I worked on
23 many, many construction jobs, I supervised inspectors
24 from one end of the St. Lawrence River to the other,
25 and I think you can get too many inspectors on a job.
26 I think it would be better to get one or two like
27 Westcoast had, good competent men, who knew their
28 stuff, and let them go, as far as the government is
29 concerned, it would be extremely hard for the government
30 to hire the quality of man that they need to carry on and

1 inspect, you know, to be a really good pipeline
2 inspector. You have to have a background in inspecting
3 on pipeline jobs, not on even road or something like
4 that. I mean he has to be a pipeliner.

5 Q Assuming the government
6 were able to buy themselves a staff of good pipeline
7 inspectors, do you envisage their being able to
8 carry out a more independent role than somebody or
9 a group of people hired by the company?

10 A No sir, in my opinion,
11 no. I think if they had someone -- the government had
12 someone like myself, looking after one spread an old-
13 timer who has been kicked around from one end to the
14 other sort of thing, but he would be a better position
15 to do the inspecting than having a number of men. You see
16 each inspector is more or less an expert in his own
17 particular field. There's the welding inspector, for
18 example, who's riding herd on the welders, the front
19 end inspector, the grader man, the trenching man,
20 they're all more or less experts in their own particular
21 discipline. And you couldn't expect one man to look
22 after more than one of these facets, in my opinion.

23 Q But you feel if the
24 government were to get for each spread, an experienced
25 person who really knew what the operation generally was,
26 even if he say, couldn't be a welding inspector himself,
27 so that he could have -- so that he could keep tabs on
28 the various operations that were going on, that would
29 be the most satisfactory solution to monitoring the
30 transmission system?

1 A Yes sir, I would say
2 one government inspector per spread would be quite
3 sufficient.

4 Q Now you referred in
5 your evidence , I believe it was your evidence in
6 chief as well as when you were showing your slides,
7 to the fact that the pipe was welded prior to the digging
8 of the trench and then it was installed, do you recall
9 from the permit whether there was some undertaking on
10 behalf of the company to make the pipe conform to the
11 bottom of the trench, because you seem surprised to
12 see that they had not done their trenching until after
13 welding.

14 A Well, I was surprised
15 but they had a darn good bender. They had a man that
16 knew his stuff and he seemed to be able to bend that
17 pipe. I watched very closely and it was very seldom that
18 the pipe was off the bottom of the trench.
19 Except in that one spot, well the odd spot where there
20 was some fill and certainly in the -- I think it was
21 the contract between Westcoast, the company and Marine
22 Pipeline was the contractors where it said they had
23 to put the pipe on firm ground and there were two or
24 three spots in the cut and fill areas where the pipe was
25 not on solid ground, and this is the only times.

26 Q So those were your parti-
27 cular areas of concern, in those places where there were
28 cut and fill operations? Generally you just found this
29 a surprising thing to do rather than necessarily just
30 a criticism of the operation?

1 A I wasn't criticizing it,
2 I thought they did a very good job actually.

3 Q Yes. Now, --

4 THE COMMISSIONER: Well the
5 conventional pipeline inspection that went on, from the
6 Pointed Mountain Line was quite satisfactory as I
7 understand your evidence. The welds were -- they turned
8 out all right, but the passage through discontinuous
9 permafrost terrain was something that they weren't
10 prepared for and the inspectors weren't prepared for
11 either is that what it gets down to?

12 A This is correct sir.

13 This is correct and we set up an arrangement, now I was
14 in the trench most of the time, I mean that was where
15 I was mostly interested and my terms of reference from
16 Indian Affairs was to make sure I knew every bit of
17 soil, identify every bit of soil that was in that
18 trench, and the permafrost areas, and the rock areas,
19 and the ground water, things like that. I was mapping
20 on the scale of 1,000 feet to the inch, on aerial
21 mosaics which Westcoast as a company had provided me
22 with. We had set up an arrangement whereby if
23 the trenching inspector who was also in charge of
24 making sure the weights were in the proper place and
25 the number of weights necessary, if I couldn't find him,
26 I would flag that area, I would put flags along the
27 side and then I would say to him, I would meet him
28 somewhere along the line and I'd say look, we hit perma-
29 frost between those two flags, and he would make sure
30 that there were weights there. But the trenching

1 inspector, if left to himself at least at the start,
2 would not have identified the permafrost. I think the
3 operator would have done first because his machine would
4 start to climb. He'd realize he was in something
5 entirely different and -- but the inspector -- towards
6 the end, they were working much better, but none of those
7 chaps had knowledge about permafrost.

1 THE COMMISSIONER: This pipeline
2 crossed the border and went into British Columbia, and
3 then travelled some distance to Beaver Lake, I think.
4 Was there anyone on the other side of the border -- I
5 take it you stopped at the border, or did you go into
6 B.C.?

7 A I went into B.C., sir.

8 THE COMMISSIONER: Oh, I see.

9 A At least I mapped right
10 through to the junction of the 24 inch line.

11 THE COMMISSIONER: The 30
12 inch line to Beaver Lake?

13 A The 24 inch line from
14 Beaver River to Fort Nelson.

15 THE COMMISSIONER: Well there's
16 a 20 inch line to Beaver River, was it?

17 A Yes, that's right.

18 THE COMMISSIONER: Okay.

19 MR. BAYLY:

20 Q You have referred to the
21 fact that the trenching inspector was in charge of the
22 weights.

23 A In the allotting of the
24 weights, yes.

25 Q Yes. Was he the man who
26 placed, or was in charge of making sure the weights got
27 onto the pipe in the proper fashion?

28 A Yes, he was.

29 Q And that was one of your
30 criticisms of this line, that as I recall your evidence,

1 that there didn't appear to be anybody who had trued
2 the weights, as you put it, I believe, to make sure that
3 they were centred properly, is that correct?

4 A This is true. Unfort-
5 unately I was not there at the time when they put the
6 weights on the pipe in behind the Fishermen's Lake, the
7 part that came up, but I was there the next day or so,
8 and before they even put the pipe in the ground, I was
9 wondering how they were going to get those weights on
10 the pipe. Once she went down in the water, they couldn't
11 see it, because the water was covered with ice. There
12 was chunks of ice floating around and it was freezing
13 quite rapidly, and when I got back onto that part of
14 the area, the weights were gone, they were in the water.

15 I checked with the inspector, and I asked him how
16 he knew those weights were centred. His reply to me
17 was "I don't".

18 MR. BAYLY:

19 Q I gather this is one of
20 the limitations of having one experienced man in charge
21 of the inspection on behalf of the government, that he
22 can't be everywhere at once?

23 A This is true. Even though
24 you have an 80 foot right-of-way as I showed on one of
25 those pictures, it's not easy to move up and down the
26 line, because the construction equipment has priority.
27 That happens, that doesn't matter where you are. On
28 any job the equipment has priority. If there's a dozer
29 moving by, even if you don't mind getting your truck
30 smashed up, you still stay out of the way.

Q Fine. Now I can appreciate

1 that. Would you feel, however, that the inspector
2 perhaps should have, if not the right-of-way, the
3 ability to be where he wanted to be, in case there were
4 problems of the nature you described?

5 A Yes, I would think so, and
6 I think in this instance the chap was there. He must
7 have been.

8 Q So you would say that you
9 would have to attribute his^{not} truing them up to either a
10 lack of experience, or lack of work with the placing of
11 weights, for example?

12 A I would say so, although
13 I would suggest that he had run into that same predica-
14 ment before. I can't see this would be the first time
15 in many hundreds of miles of pipeline that all of a
16 sudden he runs into a spot where he's putting his pipe
17 -- his weights on a pipe that's buried in the water.

18 Q Well what I am worried
19 about, Mr. Owen, is how do we get around that kind of
20 problem with any Mackenzie Valley pipeline, should
21 there be, for example, some operations manual with some
22 things that the inspector should go through in every
23 instance, to ensure this kind of thing doesn't happen.
24 Because I imagine, not only is it environmentally a
25 problem, but it's quite costly to the company to do the
26 repairs that have to be done when things like weights
27 slip off and the pipe floats up.

28 A Well this, in my opinion,
29 is a design problem. The designer who, designing this
30 pipeline and instructing where the weights should be in

1 his design, he must know there are spots where there is
2 going to be water, if there is a proper survey done ahead
3 of time.

4 Q Yes, and how do we know
5 that his design is adequate? In other words, there is
6 the kind of problem -- is there a way, in your opinion,
7 of ensuring that he has -- he, the designer, has thought
8 of everything that has to be thought of, to give us some
9 kind of confidence that the problems that occurred with
10 this pipe floating up don't occur?

11 A Well I work with design-
12 ers an awful lot, I enjoy working with them because I
13 enjoy giving them geological problems and watching them
14 try to solve them, and some of the efforts are really
15 fantastic.

16 In this case, if I was the
17 designer, I would just put river weights on it. I would
18 just weigh it down and tie them on and there's no way
19 they will come off.

20 Q All right. Now I can see
21 the designer being able to do this and perhaps I see we
22 have Mr. Williams here, I could imagine him thinking up
23 a proper way of weighting this. How does he tell his
24 man on the job what to do? That is my concern.

25 In other words, your designer
26 has designed a system of weighting, and I anticipate
27 that your answer will be that Westcoast Transmission
28 thought of putting the weights on, which was probably a
29 very good idea, but either nobody told the trenching
30 inspector that they should be trued, or he forgot, or he

1 was cutting corners, and I want to know if you have
2 thought of ways of solving those kinds of on-the-job
3 situations that lead to the kind of problems that you
4 have illustrated?

5 A I'm not -- I don't think
6 I am -- are you referring to me, talking to me?

7 Q Yes.

8 A You mentioned Mr. Williams,
9 I don't know Mr. Williams, I'm sorry.

10 Q Mr. Williams from Arctic
11 Gas --

12 MR. GOUDGE: The one man in
13 this room that doesn't know Mr. Williams.

14 MR. BAYLY: I'm sorry, Mr.
15 Owen. Let's just refer to him as the designer.

16 A I'm sorry, I have forgotten
17 your question.

18 Q All right. My question
19 basically was, how do you make sure that the things the
20 designer has thought up to guarantee the integrity of
21 the pipeline are carried through by his inspectors, his
22 workmen, his contractors?

23 A Well the inspectors, or
24 at least in the office of the company, the engineering
25 office in the field, there will be a complete set of
26 design plans, and in the morning, or whenever the inspect-
27 or goes out, it's up to him to check it.

28 Q Well how does a mistake
29 happen like the mistake that you have illustrated in
30 your evidence and the slides, where all the weights slip

1 off in a certain area and the pipe floats to the top?

2 A Well I'm not really
3 competent to say, but all I really can say with all
4 honesty, is that I wondered at the time how they were
5 going to weigh that pipe down, and the first thing I
6 knew it was down. I'm sorry I wasn't there, I'm not
7 sure how they put the weights on the pipe, whether they
8 used a crane and lowered them on, which would to me
9 would be the obvious way because they couldn't get in
10 close enough to that ditch with any sort of other
11 equipment, unless they could swing it out.

12 It was pretty wet in there.
13 Some spots you couldn't get through with a four by four.

14 Q All right. Now, I gather
15 that since you were wondering how they were going to do
16 it, that this wasn't something that you had sat down in
17 the morning of the incident, with the inspectors and
18 others, and talked through, is that fair to say?

19 A Yes, I suppose I should
20 have, but let's face it, I was not -- I wasn't sent up
21 there to check what weights were put on. I was to map
22 the materials, and with --

23 Q I am not blaming you,
24 Mr. Owen. I appreciate your job. What I'm trying to
25 get at, without putting blame on anybody, is how does
26 one ensure that these things either don't happen or
27 happen in a very small number of cases?

28 A Well once again, it's a
29 design problem and to my mind, I would have put river
30 weights on that thing, or somehow tied it down.

1 Q All right, so what you are
2 saying is that really the man in the field was doing
3 probably his very best to deal with the situation, but
4 he hadn't had enough guidance from Westcoast Transmission
5 in this case, from the design people?

6 A It would appear to be
7 that that would be the case, as far as I could see.

8 Q Thank you.

9 THE COMMISSIONER: You say you
10 use river weights. What's the difference between
11 river weights and the concrete weights that they did
12 use? What's the difference?

13 A Well the concrete weights
14 sir, that they used were a saddle weight. They fit
15 over the upper half.

16 THE COMMISSIONER: Right,
17 right.

18 A The river weight wraps
19 itself all the way around and it's bolted.

20 THE COMMISSIONER: What would
21 they bolt it to?

22 A Bolt it to each other,
23 like this.

24 THE COMMISSIONER: Oh, I see,
25 so that you get a clamp?

26 A There's no way a river
27 weight can come off.

28 THE COMMISSIONER: I see.

29 MR. BAYLY:

30 Q Now, Mr. Owen --

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1 THE COMMISSIONER: So the
2 problem with those concrete weights they used wasn't
3 that they weren't heavy enough, they just weren't
4 properly centred and they must have come off in some
5 fashion?

6 A That is my opinion, yes.

7 MR. BAYLY:

8 Q Now, Mr. Owen, we have
9 heard from you on borrow pits and seen some slides of
10 borrow facilities, that you had noted a couple of years
11 afterwards, and I gather that those borrow pits were
12 things that had opened up subsequent to your being on
13 the jobsite during construction?

14 A This is true.
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1 Q And they were borrow
2 facilities that appeared to be used for the remedial
3 measures with the exception of the ones perhaps that
4 were repaired by the seismic crews?

5 A Yes sir.

6 There were only one
7 big borrow pit area and that was for the material which
8 they used to load the pipes in the Fisherman Lake
9 area.

10 Q Now in your knowledge of
11 the permit that Westcoast got for this operation,
12 did they stipulate in their permit what borrow they
13 required and where they were going to get it and --

14 A Not to my knowledge.
15 I pointed that out to Indian Affairs that -- not to
16 my knowledge was there anything in the permit to let
17 Westcoast go beyond the limit of their area. Now there
18 may have been, but I can't recall.

19 Q And you have stated too
20 in your evidence that this is one of the reasons why
21 they appeared to use up to two or three hundred feet
22 of right of way, when in actual fact they'd made an
23 agreement with the government for 66 feet and up to
24 100 feet.

25 A I pointed that out to
26 Indian Affairs, yes. in my report.

27 Q Would you recommend in
28 the construction of future gas transmission facilities
29 that borrow requirements be better defined than they
30 were in the Pointed Mountain case?

1 A Definitely.

2 Q And that the actual
3 areas of borrow be designated?

4 A Yes sir. And the
5 quality of material.

6 Q And would you say the
7 same thing about hydrological information, not
8 only on major streams but on the smaller streams that
9 the facility must cross?

10 A I'm not qualified to
11 -- I wouldn't want to comment on that.

12 Q All right, from your
13 observations personally and in the slides that you
14 took, would you say that adequate care was taken to
15 ensure that streams, crossing the pipeline right of way
16 were handled properly?

17 A No, I don't think they
18 were. The big trouble with that line, from one end
19 to the other, is surface water erosion and the company
20 had not done enough along that line. This goes for the
21 subsidance trench, and several of the larger streams.
22 There was no real channeling of those streams. In
23 some instances, where the stream was dried up and they
24 crossed it, with the pipeline, with the trench, and
25 there was water in it, they did go a bit deeper. In
26 some instances, they tried to get through the alluvium
27 into the till. I've been down in it as much as eight
28 feet in some of those, it's not the best place to be,
29 and saw the till and in most instances, they weighted
30 there was no limit to the amount of weights. The engineer

1 there was grumbling about all the weights they were
2 using, but I thought that it was well done. But the
3 rivers the little creeks themselves weren't
4 channelled too well, and to me that was the big trouble,
5 whether it's the small creek or the LaBiche or any
6 of the other ones, there just wasn't enough thought
7 given to properly channeling, to controlling that
8 erosion. The slides all show that.

9 Q Your answer appeared to
10 be to sink it, rather than concentrate on proper river
11 and stream channeling?

12 A Yes, put it down deeper.

13 Q Yes, I noticed in your
14 slides, that the trench itself, which you earlier had
15 described as being bermed, had subsided in almost
16 all areas, even the areas that you commented had been
17 reclaimed very well, there was a slight dip where the
18 pipe was and this I gather from your report, you
19 attribute to the replacement of the ice rich material
20 as the fill on the top of the pipe or the berm, whatever
21 you wish to call it, and it consolidating and when the
22 water had gone out of it, forming this depression, is
23 that correct?

24 A That's the thought I
25 had. I'm not a soil mechanics expert, but to me that
26 was the idea. That material that went in the pipe
27 was not compacted. I don't think Westcoast or any
28 other company would want to run a cat or something
29 over there and compact that stuff, let it settle.

30 Q Now in terms of designing

1 future facilities. would you make recommendations
2 based on your experience, and I don't mean as an expert,
3 but you seem to be well acquainted with the practical
4 techniques of pipelining, what recommendations would
5 you make to make sure you didn't have this depression,
6 higher berms or --

7 A Well the higher berms
8 seem to be the obvious way. I guess that would be the
9 way I would do it. You might also, there would be
10 some spots where there might be more subsidance than
11 others and you might possibly stockpile some material
12 along the right of way, to pick it up in the wintertime
13 and dump it down some of the deeper subsidance areas.

14 Q Would you feel that this
15 should be an ongoing process, the first few years after
16 the pipeline should be placed, as part of a continuing
17 reclamation of the right-of-way program?

18 A You mean that the
19 subsidance trench is going to continue to subside, is
20 that what you're getting at?

21 Q Well if it does either
22 continue to or if there is problems show up, after the
23 first year and different ones show up after the
24 second year.

25 A I think after they
26 backfill the subsidance trench once and then build a
27 berm up a couple of feet above it, that should be
28 quite satisfactory.

29 Q All right.

30 A As I say, I'm not an

1 expert in soil mechanics but it seems to me that that
2 would be the way to do it.

3 Q I think however, you
4 referred to the berm that was built over the floated
5 section in your report as a stop gap measure, or a
6 temporary measure, would that be fair to say?

7 A Yes, that is a stop gap
8 measure because when I was there, last year, it was
9 starting to erode again.

10 Q So in that case, a berm
11 by itself was not adequate to correct the problem
12 and that's where you would recommend the river weights?

13 A Oh, in my opinion yes.
14 As I say again, that is a design problem and the
15 designers who have been doing this for years were much
16 more knowledgeable on it than I am.

17 Q So if I could isolate
18 your answer to your own expertise, something was wrong
19 with what they'd done and you think the designers should
20 have another look at it?

21 A In this particular
22 instance, yes. What they could up with I'd be quite
23 interested to see.

24 Q Do you know whether in
25 order to carry out this measure of putting the berm
26 over the floating pipe, whether or not a land use
27 permit had to be obtained or whether this was part of
28 original permit agreement?

29 A I'm sorry, I don't know.

30 Q Now in your report, you

1 refer not only to seismic equipment having damaged the
2 right of way, but also to maintenance equipment. Now,
3 was that in reference to the examples you showed of
4 where they had gone along the shoo fly road and excavated
5 not some --

6 A Not the shoo fly
7 I don't think anyone could -- I don't think anyone has
8 been on the shoo fly, they're just detours.

9 Q You did show us a borrow
10 pit that had been used to reclaim a slope.

11 A Yes, a small one.

12 Q Was that what you were
13 referring to as the -- an example of maintenance
14 equipment disturbing the right of way?

15 A Yes, but actually it is
16 extremely difficult, it was extremely difficult for
17 me to determine at that time what damage had been done
18 by the seismic and what had been done by the maintenance.
19 Obviously they both travelled the same route, and
20 the Fort Nelson man for Westcoast told me that he had
21 been in there with a cat, with a bulldozer and done some
22 work and -- but I couldn't tell which was which. There
23 was no way you could tell who was involved, except that
24 I doubted if the seismic would be interested in putting
25 a dike or a berm across the top of the LaBiche slope.

26 Q What sort of recommendations
27 would you make, Mr. Owen to ensure that the kind of
28 remedial steps that a company takes are done
29 properly and without further damage to the environment?
30 Should they take their land use inspector in with them

1 or should they consult him to see what kinds of --

2 A Yes, the land use
3 inspector at Fort Liard should be more deeply involved
4 in this. That's a problem the Indian Affairs will have
5 to face up with.

6 Q You say that as though
7 you feel they haven't really come to grips with this
8 as a problem?

9 A I understand they are
10 now. I understand. I haven't got any confirmation
11 but I've been told that they are much more serious
12 in this than they have been in the past.

13 THE COMMISSIONER: The land
14 use inspector at Liard, is that the RMO?

15 A Yes sir.

16 MR. BAYLY:

17 Q Now when we heard evidence
18 earlier from Dr. Hardy, he spoke of siltation in a
19 lake, is that Fisherman's Lake?

20 This is caused by the
21 facility.

22 A I presume it would be
23 Fisherman's Lake, it's the only lake there.

24 Q You didn't see any
25 evidence of this yourself?

26 A No sir.

27 Q Do you know from your
28 knowledge of the permit whether the bond that is put
29 up is to be used to pay for any of the reclamation that
30 has to be done?

1 A No, I do not, I don't
2 know the status of that at all.

3 Q Do you feel, Mr. Owen,
4 that you went in a bit late yourself, I don't mean that
5 it was your fault necessarily, but that a person should
6 have been sent in to inspect this sooner after the com-
7 pletion of the facility?

8 A No, I do not, I think that
9 the time that I went in was just about right.

10 Q I see. You spoke of
11 some gulleys and showed us some pictures of some gulleys
12 that you said were as much as five feet deep at the time
13 you went in. Would an earlier inspection have caught
14 some of those at an earlier stage and perhaps prevented
15 some slope ---

16 A An inspector doesn't
17 prevent anything, sir.

18 THE COMMISSIONER: Yes, that's
19 what I was thinking. What could you have done about it?

20 A I couldn't have done
21 anything. I just would have pointed out that there
22 was surface water erosion taking place.

23 MR. BAYLY:

24 Q I said that badly. Do
25 you feel that an inspector going in and making a report
26 earlier would have caused something to be done before
27 gulleying got to that stage or did you not have that
28 kind of power to force the company to do those types of
29 things?

30 A Well I personally haven't

1 got that power. My recommendations go directly to
2 Indian Affairs, and after I have written my report, I
3 might be anywhere else in the country and I may not
4 hear of it any more.

5 This particular report here
6 that's published, that was -- I thought a confidential
7 report written by myself for the information of Indian
8 Affairs, and they decided to publish it. It wasn't my
9 idea at all.

10 I write, sir, an average of
11 -- on an average of one of these every three weeks,
12 all over the country for various departments, for depart-
13 ments I'm more or less associated with now, and some of
14 them, I would say most of the publications I have put
15 out have been of that type. Somebody has decided there's
16 enough information in it to warrant publication.

17 Q All right.

18 A But I myself, I had nothing
19 to do with the publishing. I prepared the report,
20 presented it to Indian Affairs as their consultant, and
21 they thought that they should publish it and it's out.

22 Q All right. You sound as
23 though you are critical of publishing of these reports
24 in a general way, and I'm just wondering about that,
25 whether you feel that some of these inspection reports,
26 like the ones that you do, should be made available to
27 the public so that they will know what the problems are,
28 and to perhaps put pressure on, if necessary, to make
29 sure that the situations are corrected?

30 A I think that some of them

1 that contain, especially those that contain new geologi-
2 cal knowledge, should be published, but just to publish
3 a report for the sake of publishing it, I'm not personally
4 the least bit interested. I have too many things else
5 to do.

6 I have, down on the St. Law-
7 rence Seaway, for example, I had to write a counterclaim
8 against a contractor who wanted almost four million
9 dollars' claim. I went to a lot of detail in that
10 and the result was that the government decided to pub-
11 lish it, there was so much information in it. But most
12 of the reports which I have prepared are limited distri-
13 bution, that's what they call them.

14 Q Yes. I'm interested in
15 this report from the point of view of when they publish
16 it, do they publish it in total, or just selections
17 from it?

18 A Oh no. That's pretty
19 well the way I wrote it. There are a few minor changes
20 which we discussed, but as far as the report is con-
21 cerned, I have to assume responsibility for it.

22 Q Yes.

23 THE COMMISSIONER: Those notes
24 that are passed to you, Mr. Bayly, do they say "Time's
25 up" or?

26 MR. BAYLY: I think you are a
27 bit hopeful, sir.

28 THE COMMISSIONER: Well then,
29 let us stop for five or ten minutes, and stretch our
30 legs.

(PROCEEDINGS ADJOURNED)

1 (PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

2 THE COMMISSIONER: I should
3 say that I circulated among the Inquiry Staff a draft
4 schedule of hearings for the new year and if counsel
5 wish to pick up a copy from Miss Hutchinson, she has
6 extra copies, just get one and if you want to comment
7 on it, you might do so tomorrow before we adjourn if
8 you wish and we'll take your comments into account
9 certainly.

10 Carry on Mr. Bayly.

11 MR. BAYLY:

12 Q Mr. Owen, you refer in
13 your report at pages 6-7 to what appears to be a failure
14 of the system to monitor what happens after the
15 transmission facility is in place and I'll quote a para-
16 graph to you from that page. "The maintenance manager
17 for Westcoast transmission stated that the company has
18 no authority over seismic operators using pipeline and
19 was of the opinion that these operators would be under
20 the jurisdiction of either the National Energy Board
21 or the Northwest Lands and Forest Service.

22 Now, in light of that paragraph,
23 would you recommend that after the facility has been
24 installed, that the company continue to have some say
25 in what happens on the right of way, or should there be
26 some other way of monitoring this that is more successful
27 than what we've seen in the Pointed Mountain example?

28 A In my opinion, when the
29 company has put as much money as they have into that
30 pipeline, they should have something to say with how it's

1 going to be looked after. I'm not sure of the exact
2 figure, but someone told me that Westcoast Transmission
3 cost \$18 million dollars to put that pipeline in.
4 Now how close that is I don't know, but this is an
5 awful lot of money. I think they should have some
6 say on what happens to that pipeline, even though they
7 only have a lease on the land, they don't really own
8 it do they?

9 Q No, I believe that in
10 the agreement they don't own it. In fact I think they
11 pay 30 some dollars a year for it.

12 Now, given that they should
13 have some say in what happens on that right of way,
14 would you feel that that would also ensure that if any
15 problems occurred, on the right-of-way, that they
16 would be responsible for the repairs?
17 Or would you see that as a shared responsibility with
18 someone else?

19 A What sort of problems
20 are you referring to?

21 Q Well you showed us in
22 your slides for example, several streams that were
23 blocked up by the seismic operators, that somebody
24 should unblock, I assume, and you've shown us some
25 -- the start of some erosion caused by caterpillar
26 tractors and other vehicles using the right of way
27 either after the spring thaw or prior to the winter
28 freeze up. I gather these things should be repaired
29 and somebody has to pay for those repairs. Have you
30 as a result of your inspection, formed some opinion or

1 have you some recommendation to make as to how that could
2 be performed and who should look after it?

3 A In my opinion, if a
4 seismic operator is planning on using a line such as
5 this to move his equipment, he should post a bond
6 similar to what Westcoast had to bond, post a bond and
7 if he can't fix it up, then the government can and
8 deduct it from the value of the bond. That's my idea.
9 That is my opinion I should say.

10 Q And in addition to that
11 you feel that the company should be consulted as to
12 whether anyone should be even allowed to have permission
13 to use that right of way, is that the other part of
14 your recommendation? That was your answer to the
15 previous question.

16 A This is an ideal
17 situation but I don't think that the company could
18 prevent some sort of traffic along or over the line.
19 They can't block off well, 600 miles of land without
20 having some way for people to pass over it or under it.

21 Q So you see that people
22 are going to use it anyway, no matter what you do?
23 What about policing it, Mr. Owen. Have you thought
24 of ways that you might police a facility like this to
25 ensure that people use it to a minimum or in the case of
26 a seismic operator who doesn't declare he's going to use
27 it and uses it, that you've got some system of con-
28 trolling them?

29 A Well an inspector should
30 do it. I worked along that gas -- or that high test

1 fuel line from Haines Alaska, that came up the Haines
2 Road and then along through Haines Junction, along the
3 Alaska Highway into Fairbanks. This was a jet fuel
4 line and the U.S Army had a chopper -- a helicopter
5 that flew that every day, real down low and this was an
6 inspection which carried on continuously. I've
7 actually sat on that line and ate my lunch and had the
8 helicopter circle over me and keep on going. Now this
9 was a U.S. chopper too and I would say this would be
10 about the best way of handling it.

1 Q It would be just as well
2 that they didn't do anything more than that to you.

3 Now, I gather that one of the
4 possible abuses of the system as it presently is, is
5 that everybody denies responsibility for damage to the
6 transmission right-of-way?

7 A This is correct. From my
8 own experience this happens all the time.

9 Q And so when it comes to
10 deciding whether or not a company like Westcoast should
11 have its money back, you may go through a great deal of
12 argument over whose fault it was in the first place
13 that the damage was done?

14 A This is correct.

15 Q You are satisfied, I under-
16 stand from your report, that they didn't live up entirely
17 to their indemnity agreement to their permit as they had
18 received it?

19 A Not entirely. They did
20 not live up to it entirely. I thought that Westcoast
21 did a good job, all in all, but they still missed out
22 on this control of surface water erosion, which is the
23 big culprit as far as any damage now on the line.

24 Now, the other damage, I
25 blame substantially on the seismic people. I would
26 say that it would be up to the R.M.O. to check those
27 out. In Fort Liard he's only 20 miles away from that
28 line. There's no reason why -- in the winter he can
29 drive over there with a truck. In the summer it's
30 a chopper, just a short haul.

1 Q Yes. I gather when we
2 are giving out awards for some of the problems that
3 have occurred on this line, that in your opinion we
4 should give some of them to whoever made the decision to
5 permit the use of the gravel in the river, and from the
6 river, to shore up the part of the pipeline that had
7 become exposed, prior to your arrival?

8 A Yes. My background with
9 the gravel in the river dates back to when we started
10 to do a gravel survey, a gravel inventory, as it were,
11 from Fort Simpson up to Tuk, and over to Arctic Red,
12 McPherson and up the east side of the delta, right up
13 to the Arctic coastal plain, and we had three consult-
14 ants working on that job at various times, and we spent
15 well over a million dollars.

16 As you probably know, the
17 result is those 23 one inch to two mile granular mater-
18 ials map which Indian Affairs produced, and in all of
19 the contract -- the specifications we laid down to those
20 consultants, the three of them that worked, river
21 gravels were out. We weren't the least bit interested
22 in touching anything in the rivers. That includes --
23 well everywhere, there was no way, we were interested in
24 the stuff that was land based.

25 Much to my surprise, I walk
26 into the Kotaneelee and lo and behold, here's a berm
27 pushed in and you could see the cat marks out in the
28 river. Now he just hadn't front-end loaded that across.
29 He had actually pushed it through the water, and up the
30 other side as the picture showed.

1 Now, I don't know whether the
2 company got special permission for that. I just pointed
3 out the fact to Indian Affairs, and I have no idea what's
4 happened since then.

5 Q In your experience in the
6 kinds of projects you've been in, would you agree that
7 when somebody has a facility that's put in and there's
8 a problem that often permits are granted for things that
9 might not have been granted without an emergency situation?
10

11 A I don't know whether it's
12 happened. In my own experience, that hasn't happened
13 before. When they opened up the small borrow pit for
14 the concrete aggregate on the LaBiche, the -- they got
15 permission from Fisheries to use that material, and I
16 never saw the actual permit, but I was told that they
17 could take out approximately -- they were permitted to
18 take out approximately one thousand cubic yards of
19 material, but that after it was finished they had to
20 level off the ground so that there would be no fish
21 caught in any little hollow in this bar.

22 Actually, as most construction
23 jobs are, the concrete was pretty well all made before
24 they got the permit through, but still that's the way
25 it worked out.

26 Q Yes, and that's another
27 one of the problems, isn't it, with these kinds of jobs,
28 that very often the granting of permits lags behind an
29 on-going project?

30 A This is true.

1 Q And if I were to suggest
2 to you that a solution to this might be to have these
3 contingencies mapped out prior to the first caterpillar
4 tractor being allowed on the job, that some of these
5 things might be better thought out than they were in the
6 case of the Kotaneelee River?

7 A Well it surprised me that
8 the company had not actually located a satisfactory, a
9 more satisfactory supply of granular materials than they
10 had, and as an engineering geologist who has worked
11 many, many years in this sort of business, and having
12 just come off a job in the Niagara Peninsula where we
13 were running head-long into the Ontario Department of
14 the Environment, trying to find a place to open up
15 quarries along there for our big job, we wanted hundreds
16 of thousands of yards of aggregate.

17 It didn't make sense to me.

18 Q All right. So what you
19 are telling me by that is that it can be done, that you
20 can have an authority that looks very carefully into
21 these things prior to granting permits to remove gran-
22 ular materials from anywhere, and that just doesn't
23 appear to have been done in this situation?

24 A Yes.

25 Q To be --

26 A Admittedly, I flubbed it.
27 I am quite willing, because when I went in on that job,
28 I should have looked for gravel just out of my own
29 personal curiosity. I had just come off a job where
30 we, before we touched any rock from any quarry, we wanted

1 to see where that rock had been placed. We wanted to
2 see the mix specifications and all the rest, and I
3 wandered many days up and down the Queen Elizabeth High-
4 way looking at overpasses and underpasses, and checking
5 back to the quarry from which that rock came. So I go
6 up to there, I never thought, I never saw any concrete.
7 Well, it turned out that the dehydration plant and
8 the AMOCO's camp at the Beaver River Inn, it was on
9 concrete, but we couldn't see it, it was all snow.

10 It wasn't until later on in
11 the season, near the end, when one of the marine pipe-
12 line people asked me if I wanted to see a good gravel
13 pit. I thought he was joking, but he took me about half
14 a mile up the road beyond the Beaver River processing
15 plant, and there was the most beautiful gravel pit you
16 ever saw just staring us in the face.

17 Q So the --

18 A I flubbed it, I admit.
19 That was something I should have checked out, just out
20 of personal curiosity.

21 Q So the material was there,
22 it was just that the opportunity wasn't taken to use
23 it?

24 A This was not on the job.
25 This was a good half mile to a mile away from the end
26 of the pipeline, which meant that they opened up a pit
27 there and they would have to haul those weights right
28 down the line, which would be quite expensive.

29 Q But this is one of the
30 reasons for your feeling that these things should be

1 mapped out prior to the start of any project that re-
2 quires --

3 A Yes.

4 Q -- borrow facilities?

5 A I was surprised that they
6 hadn't found a more satisfactory supply of concrete
7 aggregate before the job started.

8 Q Yes. Now, my information
9 is that in some places that the berm was not placed
10 correctly on the facility, and do you know anything
11 about that?

12 A Only in one instance and
13 it was rectified within a hour. I spotted one spot
14 where the cat driver had missed about 500 feet. The
15 cat skinner that was making the berm, and he was not over
16 the pipe, the buried pipe whatsoever.

17 Are you thinking of the berm
18 after the pipe was put down, or the berm that was put
19 down before they actually --

20 Q Well I was thinking of the
21 berm over the pipe, and that was the instance you are
22 talking about?

23 A Yes, this is true. There
24 was one spot about 500 feet, but I mentioned it to the
25 bulldozer super, and he was right in there and had it
26 fixed up in no time.

27 Q Yes.

28 A I understand, though, on
29 the other line between Beaver River and Fort Nelson, in
30 B.C. there's an awful lot of places where they missed

1 out. I saw some of them myself.

2 Q Yes. You were inspecting
3 only that portion in the Northwest Territories?

4 A Well, --

5 Q I mean, you --

6 A I don't stop, political
7 boundaries don't mean too much. You go ahead and map
8 the whole thing. I was interested in what was going on
9 down in B.C., it was only two miles, two point something
10 miles. I mapped the whole thing.

11 MR. BAYLY: Those are all the
12 questions I have. Thank you very much, sir.

13 MR. OWEN: Thank you.

14 MR. GOUDGE: Now,
15 In order of cross-examination, Mr. Commissioner, in terms
16 of adversity of interest, it would seem to me that
17 perhaps Mr. Hollingworth ought to go least, and that
18 would leave Mr. Marshall next.

19 I wonder if given that Mr.
20 Marshall may have only a few questions, we might con-
21 sider prevailing on the reporters through that cross-
22 examination, and then giving them a well deserved
23 break.

24 THE COMMISSIONER: Yes.
25 Excuse me, Mr. Marshall, I don't think we should sit
26 much longer. If you have got a half hour of questions,
27 I think we should leave it until the morning.

28 MR. MARSHALL: I only have one
29 area, sir.

30 THE COMMISSIONER: All right.

1 MR. MARSHALL: I don't know
2 that it will take more than a minute, so --
3

4 CROSS-EXAMINATION BY MR. MARSHALL:
5

6 Q Sir, my area of interest
7 is with respect to taking gravel from rivers, and there
8 has, I believe, been a report entered in the proceedings
9 before this Inquiry dealing with the Alyeska experience
10 in taking gravel from inactive flood plains. There was
11 a report done by Northern Engineering Services. Are
12 you aware of what's been going on in that connection on
13 Alyeska?
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1 A No, sir, I am not.

2 Q I was wondering, sir,
3 if you would have had any discussions with environ-
4 mentalists to the effect that there are considered by
5 some environmentalists, at least, to be environmental
6 advantages to taking gravel from inactive flood plains,
7 rather than taking it from, say, undisturbed upland
8 areas?

9 A No, sir, I have not at
10 any time discussed this problem with environmentalists.

11 Q Well, do you have an
12 opinion on that, sir, or is it something really outside
13 of your field of expertise?

14 A It is really outside of
15 my field. I am not an environmentalist at all.

16 MR. MARSHALL: Well, I
17 expect that we may get into this in the next phase,
18 sir.

19 Thank you, sir.

20 THE COMMISSIONER: Well,
21 I think that we will prevail upon you to remain until
22 tomorrow morning, if you wouldn't mind, Mr. Owen, and
23 Mr. Hollingworth of Foothills has some questions,
24 but he can ask those in the morning and then we will
25 let you go, and then we will hear the remaining wit-
26 nesses in this phase.

27 MR. GOUDGE: Nine o'clock
28 tomorrow morning?
29

30 THE COMMISSIONER: Nine o'clock.

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